EXHIBIT V

REDACTED VERSION OF DOCUMENT SOUGHT TO BE SEALED

Steve W. Berman (*pro hac vice*)
HAGENS BERMAN SOBOL SHAPIRO LLP
1918 Eighth Avenue, Suite 3300
Seattle, Washington 98101
Telephone: (206) 623-7292
Facsimile: (206) 623-0594
steve@hbsslaw.com

Shana E. Scarlett (217895)
HAGENS BERMAN SOBOL SHAPIRO LLP
715 Hearst Avenue, Suite 202
Berkeley, California 94710
Telephone: (510) 725-3000
Facsimile: (510) 725-3001
shanas@hbsslaw.com

Marc A. Goldich (*pro hac vice*)
Noah Axler (*pro hac vice*)
AXLER GOLDICH, LLC
1520 Locust Street, Suite 301
Philadelphia, PA 19102
Telephone: (267) 534-7400
mgoldich@axgolaw.com
naxler@axgolaw.com

Attorneys for Plaintiffs and the Proposed Class

UNITED STATES DISTRICT COURT

NORTHERN DISTRICT OF CALIFORNIA

SAN FRANCISCO DIVISION

IN RE SEAGATE TECHNOLOGY LLC LITIGATION

No. 3:16-cv-00523-JCS

REBUTTAL DECLARATION OF ANDREW HOSPODOR IN SUPPORT OF PLAINTIFFS' MOTION FOR CLASS CERTIFICATION

DATE: March 30, 2018
TIME: 9:30 a.m.
DEPT: Hon. Joseph C. Spero
Courtroom G, 15th Floor

REDACTED VERSION OF DOCUMENT SOUGHT TO BE SEALED

TABLE OF CONTENTS

Page

I. INTRODUCTION 1

II. SUMMARY OF REBUTTAL OPINIONS 1

III. REBUTTAL OPINIONS 3

A. Adams Ignores the Fact that Seagate Shipped Millions of Bad, Unreliable, Drives to Consumers 3

1. Adams' Position that Ship Holds Prevented Bad Drives from Reaching Consumers is Nonsensical and Contradicted by the Ship Hold Documents 3

2. For a Single Contamination Issue Alone, Seagate Shipped at Least 850K Affected Drives 11

B. Post-Release Testing Reveals that the AFR was Consistently Higher than the Advertised AFR 16

C. The True AFR was Higher than Projected by Seagate and the AFR was Increasing 25

D. The Backblaze Reports Evidence An Increasing, Abnormal Annual Failure Rate 26

E. Adams Ignores Key Documents Showing That Seagate Falsely Marketed The Drives Throughout The Class Period 29

1. Seagate Advertised the AFR as 0.34% and below 1% during the Class Period 29

2. Drives were Marketed as Reliable Throughout the Class Period, but Were Highly Unreliable 33

3. Seagate Documents Indicate That The Internal Drive Kit was an SBS Drive 36

F. Adams Ignores That The ECR Logs and Changed Specifications Demonstrate the Drive was Unstable and Shipped Prematurely 37

G. Supplementation of Opinions 47

I. INTRODUCTION

1. I, Andrew Hospodor, was retained by counsel for Plaintiffs in *In Re Seagate Technology, LLC, Case No. 3:16-cv-00523-JCS*, to determine whether the ST3000DM001 had a higher than advertised Annualized Failure Rate ("AFR") and whether it was suitable for RAID. I have also been asked to opine, based upon my knowledge of hard drive industry's best practices, on the ST3000DM001's level of reliability, as well as the design and manufacturing processes employed by Seagate for the ST3000DM001, including reliability testing and quality control. I concluded that the ST3000DM001 had a higher than advertised Annualized Failure Rate, was unsuitable for RAID, and was unreliable by industry standards and that Seagate was aware of these issues.

2. I previously submitted a Declaration on November 8, 2017 ("Hospodor Declaration") where I set forth my opinions and conclusions which were based upon methods and analyses of a type reasonably relied upon by experts in my field in forming opinions or inferences on the subject.

3. I submit this Rebuttal Declaration in response to the Declaration by Donald Adams, PE, dated January 5, 2018 ("Adams Declaration"), submitted by Seagate Technology LLC in opposition to Plaintiffs' motion for class certification in this matter. Throughout this Declaration, I refer to the hard drives at issue in this litigation – the ST3000DM001 bare drive as well as the external hard drives using the ST3000DM001 – as the "Drive" or "Drives."

4. A list of the documents I have relied on or considered in forming my conclusions are attached hereto as Appendix 1.

II. SUMMARY OF REBUTTAL OPINIONS

5. Based on a thorough review and analysis of the Adams Declaration, I have formed the following opinions:

- The Adams Declaration misleadingly ignores that Seagate shipped over a million defective Drives to consumers. Adams claims that consumers did not receive bad Drives with a high annualized failure rate ("AFR") because Seagate performed ongoing reliability testing ("ORT") and implemented "ship holds" to freeze shipments of defective Drives. However, Adams either does not realize or ignores the fact that Seagate shipped multitudes of bad Drives to consumers

before the ship holds were put into place. In fact, several Stop Ship Orders explicitly stated the number of *affected* Drives that had *already* been shipped to consumers at the time of the ship holds. Based on these documents and the other evidence reviewed, I conclude that Seagate shipped over a million defective, unreliable Drives that ultimately reached consumers.

- The Adams Declaration's arguments regarding the magnitude of the Apple recall are erroneous in that they ignore facts and are based upon faulty reasoning. Adams ignores that the Drives affected by the contamination issue that led to the Apple recall were Grenada BP, which contradicts his overarching (erroneous) argument that there is a dearth of evidence pertaining to problems with that Drive version. Seagate sold at least 850,000 non-OEM (i.e. disty/SBS) Drives that were affected by the same contamination problem, and Seagate never issued a recall for them. Based on the evidence I have reviewed, I conclude that contamination (and other systemic problems affecting reliability) was not limited to the Grenada Classic, Grenada BP, or the pre- May 2013 timeframe, but was rather a constant and major issue throughout the class period and across all iterations of the Drive.

- The Adams Declaration's contention that no other OEMs "reported problems with the Drives" is belied by the evidence. [redacted]

- The Adams Declaration ignores that, among other things, Seagate's own ORT of the Drives reveal that Seagate was aware that the Drives were unreliable and had an AFR that was higher than industry standard. The argument that there is "no evidence that Grenada BP or Grenada BP2 drives had AFRs over 1%" is wholly incorrect and contradicted by the evidence.

- In addition to erroneously dismissing that the Drives' field AFR was higher than Seagate's projected AFR, the Adams Declaration ignores the fact that the Backblaze reports evidence that the AFR of the Drives increased over time (i.e. they had a Weibull beta of >1). Indeed, the Backblaze data demonstrates that the ST3000DM001 was significantly less reliable than its competitors and exhibited a dramatically increasing failure rate.

- The Adams Declaration mischaracterizes the Hospodor Declaration, misrepresents the extent to which Seagate marketed the Drives as being highly reliable, and ignores that this case involves Seagate's failure to disclose that the ST3000DM001 had a high AFR and was unreliable, both of which I conclude were known by Seagate. Adams' opinions regarding the external Drives also indicate that he is not familiar with the type of external Drives at issue in this litigation or with consumer operating environments.

- The Adams Declaration's contention that the number and pattern of ECRs cannot be used to determine AFR is little more than a straw man. No such claim was made in the Hospodor Declaration. Rather, the point that Adams selectively ignores is that an ECR rate of more than one a day is indicative of an unstable, prematurely released product. Indeed, the sheer number of post-release changes show that each iteration of the Drive was unstable and released prematurely to consumers.

III. REBUTTAL OPINIONS

A. Adams Ignores the Fact that Seagate Shipped Millions of Bad, Unreliable, Drives to Consumers

1. Adams' Position that Ship Holds Prevented Bad Drives from Reaching Consumers is Nonsensical and Contradicted by the Ship Hold Documents

6. Adams' claim that defective Drives were not shipped to consumers defies logic and is flatly contradicted by Seagate's ship hold documents. Adams asserts that the post-release ORT discussed in the Hospodor Declaration and at length herein are irrelevant because ship holds prevented any bad Drives from reaching consumers.[1] That is not true. Adams either misses or ignores the fact that numerous ship hold documents, including the Stop Ship Order for one of the ship holds that Adams relies on, ***list the number of affected Drives that were shipped*** to customers before the ship hold was put in place.[2] Accordingly, even if a ship hold stopped Drives from being shipped to consumers after it was implemented, it did nothing with respect to Drives that had already been shipped and sold that suffered from problems that later led to a ship hold.

7. Seagate conducts ORT on a rolling basis, whereby each week 100 to 200 drives are selected for testing that lasts six weeks.[3] ORT therefore consists of a pipeline, with the oldest drives being under test for 6 weeks and the newest drives just starting their testing. In such a system, it will take a certain amount of time for problems to occur and for them to propagate through the pipeline. By the time a trigger point is reached, it is inevitable that multiple days or

---

[1] Adams Decl, at ¶ 22, 48, 64-65.

[2] *See* FED_SEAG0054972. Unsurprisingly, Adams does not cite this Stop Ship Order, but simply cites Netel's declaration for the general proposition that a ship hold had been implemented.

[3] Netel, Decl., at ¶ 11.

weeks of production would have occurred with the bad parts, processes, firmware, or other components. These Drives may still be works-in-progress ("WIP")[4] or Finished Good Inventory ("FGI")[5], or they may have already been shipped.

8. In addition to the fact that Seagate's ORT and stop ship mechanisms, by their nature, do not prevent all bad Drives from reaching consumers, an internal Seagate email suggests that Seagate was careless in handling stop ship and quality control processes for the Grenada. In response to an email regarding a July 2012 ship hold, John Grieci, an electrical failure analysis engineer at Seagate, said:

> What are we doing here with Granada [sic]? We seem to trigger often. We shipped 145K drives and we are holding 31K drives to screen I guess? This makes no sense!!! We are not managing quality here, we are just shipping product that will bite us later.
>
> We NEED a longer term plan here. This drive does not seem like a good drive . . . .[6]

9. This ship hold was for particle contamination, and, as can be seen from the above-quoted language, Seagate shipped 145,000 affected Drives in this one instance alone. As discussed in greater detail below, Seagate shipped approximately 320,000 affected Drives in another instance. In total, Seagate shipped **at least 1.9 million** defective Drives despite ship holds being implemented, and **potentially millions more**.[7]

10. As discussed in the Hospodor Declaration, an ORT document dated February 7, 2012 reveals that the AFR for the Drive was above 1% for 12 weeks straight and reached 2.21% and was trending higher.[8] A ship hold was put in place near the end of this twelve-week period, on February 4, 2012, due to the Mean Time Before Failure ("MTBF") limit being breached.[9]

---

[4] WIP refers to Drives that are in the process of being built or assembled but not yet completed.

[5] FGI refers to Drives that have been manufactured but are still at the factory awaiting shipment.

[6] FED_SEAG0060976, at 60978.

[7] Included in the 1.9 million figure are 850,000 Drives that were shipped with a defect that later prompted a recall by Apple, which is discussed below.

[8] FED_SEAG0009670, at 9681.

[9] FED_SEAG0054972, at 54973.

Specifically, the Stop Ship Order states that ORT MTBF was at 90,000 hours, which is nearly three times worse than Seagate's 250,000 hour specification.[10] The Stop Ship Order further states that in the four weeks leading up to the ship hold, Drive failures had doubled.[11] The ship hold covered disty Drives but not Seagate Branded Storage ("SBS") Drives sold to consumers, even though these were the same ST3000DM001 Drives that were not meeting the MTBF specification and were failing ORT at an increasing rate.[12]

11. Adams claims that the 12-week ORT AFR data is immaterial because the ship hold prevented bad Drives from reaching consumers.[13] Adams ignores the fact that the ship hold did *not* apply to SBS Drives. Adams also disregards, or misses, the fact that the Stop Ship Order itself includes a table listing the number of affected Drives that were WIP (meaning works-in-progress), FGI (meaning still at the factory and awaiting shipment), and Shipped.[14] It includes all three factories at which the ST3000DM001 was produced: Korat, Thailand; Wuxi, China; and SuZhou, China. As can be seen by the table, reproduced below, **320,025 drives had been shipped** from the Korat factory alone.[15]

ORT SSO# 0187	WIP	FGI	Shipped	Total	Remark
Korat	46568	25063	320025	391646	
Wuxi	Under data crunch	81625	Under data crunch	81625	2TB under identify for affected from 12400 drive.
SuZhou	Under data crunch	231590	Under data crunch	231590	2TB under identify for affected from 37400 drive.
Total	46568	338278	320025	704861	

***Figure 1*: Qnty. of Drives impacted by the 2/4/2012 ship hold, FED_SEAG0054972, at 54974.**

[10] *Id.* The lower the MTBF, the less reliable the hard drive. All else being equal, a lower MTBF equates to a higher AFR.

[11] *Id.*

[12] *Id.* Dewey, Almgren, and Adams assert that Seagate requires SBS Drives to meet an MTBF of only 100,000 hours (equivalent to 2.37% AFR with a 2400 power on hours assumption). However, Seagate marketed its hard drives to be used more than for occasional backup, such as for home servers or storage expansion, as discussed below. Such a low MTBF target is inappropriate for such uses and inconsistent with the representations Seagate made to consumers. Nonetheless, the MTBF was below even the 100,000 hour target, at 90,000 hours, yet Seagate did not stop ship the SBS Drives.

[13] Adams Decl., at ¶ 65.

[14] FED_SEAG0054972, at 54974.

[15] It bears noting that the ship hold at issue applied to the 1TB, 2TB, and 3TB ST3000DM001 Drives. It does not break down the number of shipped Drives by capacity.

12. This table notes that the shipped data for Wuxi and SuZhou were not yet available. However, if the ratio of Shipped to FGI is roughly the same for all three factories (i.e. about 12.7:1), then Wuxi would have shipped 1,042,255 affected drives and SuZhou would have shipped 2,957,131 affected drives. Although these last two numbers are speculative, it is clear from the Stop Ship Order that the shipped quantities from Wuxi and SuZhou were likely substantial. Thus, this document clearly shows that, contrary to Adams' argument that no affected Drives were shipped, **hundreds of thousands, and possibly millions, of out-of-specification drives were shipped in this one instance alone.**[16]

13. Adams also attempts to dismiss as irrelevant ORT results from June 4, 2012.[17] There, Seagate discovered that the Drives had a raw AFR of 3.436% and a projected AFR of 2.35% after corrective actions.[18] Adams claims that these results are irrelevant because a ship hold purportedly prevented the Drives in question from being shipped to consumers.[19] Adams' argument is baseless.

14. The ship hold referred to by Adams was put into place on May 31, 2012 and was due to a faulty Disk Separator Plate ("DSP") in the Drive.[20] The Ship Hold Order does not mention how many affected Drives had already been shipped, but the number was likely substantial, as the DSP was released two years prior to the ship hold and was used "since early

---

[16] Adams' argument is also belied by the length of the ship hold. It was implemented on February 4, 2012 and released on February 8, 2012 (i.e. it was in place for 4 days). *See* FED_SEAG0055127, at 55130 (lists creation date of the SSO as February 4, 2012); *id.* at 55127 ("SSO is released for Disty/OEM based on paper sort criteria as of Feb. 8"). Adams does not point to any documentation that supports the notion that a ship hold was in place for the entire 12-week period. Indeed, it is obvious that ship holds were not in place for the entire period, as such a stoppage would have undoubtedly created a veritable blizzard of documents.

[17] Adams Decl., at ¶¶ 63-64.

[18] In his declaration, Netel criticizes my analysis of the ORT results on the basis that the results I reported are the "raw" AFR. *See* Netel Decl., at ¶ 21. That is a misleading statement. The 3.436% figure is the raw AFR, but 2.35% is not the raw AFR but rather the reduced AFR projection, which reflects the effects of the fixes Seagate implemented.

[19] Adams Decl. ¶¶ 63-64.

[20] FED_SEAG0054950.

Gen development phases."[21] Accordingly, Adams' argument that the DSP ship hold prevented any bad Drives from reaching consumers is unfounded.

15. The DSP ship hold was lifted on June 14, 2012, and it appears that it was lifted despite the AFR still being high. Netel claims in his declaration "Seagate would have implemented fixes to reduce the AFR below the trigger limit before shipping drives . . . ."[22] However, Netel provides no documentary evidence that this was indeed the case for this ship hold. To the contrary, the June 4, 2012 ORT results demonstrate that Seagate only projected the reduction of AFR from 3.436% to 2.35% (not <1%), which is still nearly seven times greater than the advertised AFR of 0.34%. Moreover, the "potential reduced AFR" projection was 1.79%. Potential reduced AFR is an unproven projected value; that is, it is the AFR Seagate thinks it can accomplish if its corrective actions achieve their maximum effectiveness. A "potential reduced AFR" of 1.79% indicates that Seagate did not believe that it could meet the advertised AFR even after corrective actions met their maximum projected effectiveness.

16. The above ship holds are not the only instances where defective Drives reached consumers. In one instance, Seagate shipped over 303,000 Drives with a bad preamp component before implementing a ship hold.[23] In another instance, Seagate shipped 152,164 Drives with a defective part called a crashstop.[24] By way of further example, Seagate shipped 219,889 Drives from a batch that had unacceptably high thermal voltage margin ("TVM") failure rates.[25] Additionally, in another instance, Seagate put a ship hold in place for OEM Drives, 85,000 of which had already been shipped, and instructed the factories to "Downgrade failed drives to Disty and SBS."[26]

---

[21] FED_SEAG0026751, at 26781.

[22] Netel Decl., at ¶ 21

[23] FED_SEAG0055139, at 55140

[24] FED_SEAG0016862, at 16863

[25] FED_SEAG0058176, at 58180.

[26] FED_SEAG0055041, at 55043-44. As discussed in the Hospodor Declaration, Seagate used SBS and disty as a dumping ground for failed OEM Drives. Regarding "downgrading" Drives to SBS, Netel contends that Seagate "always validated that the drives passed testing for SBS before shipping." As discussed above, Seagate's MTBF benchmark for SBS Drives is 100K hours. For Drives such as the GoFlex Home and Expansion Desk, which are not

17. These examples, along with the ship holds discussed previously, account for **over a million drives**. The true number of shipped drives is likely substantially higher, given that: (1) Seagate did not place a ship hold on the DSP until a year after the Drive's initial release;[27] (2) the number of Drives shipped from Wuxi and SuZhou before the February 7, 2012 ship hold was implemented is not listed; and (3) there were many other ship holds and a recall by Apple, as discussed below.

18. As mentioned in the Hospodor Declaration, Seagate put at least 13 ship holds on the drive between June 2011 and August 2012 alone. Indeed, additional Seagate documents suggest that there were more.[28] Adams observes that the ship holds I cited were from 2011 and 2012 and, with one exception, for the Grenada Classic.[29] This is a valid observation. However, this does not mean that there were no ship holds outside of 2011 or 2012 or that the ship holds were essentially limited to the Grenada Classic. Other examples beyond those cited in my opening declaration are:

- FED_SEAG0054844: Dated July 19, 2012, showing Grenada BP being placed on ship hold.
- FED_SEAG0057538: Dated November 23, 2012, showing both Grenada Classic and Grenada BP drives being placed on ship hold for contamination issues.[30]

---

occasional-use backup Drives, a 100K hour MTBF is very low. A 250K hour MTBF, the same as Seagate's internal disty Drives, would be more appropriate. In any event, Netel's confidence in Seagate's validation processes was not shared by everyone at Seagate. In response to a ship hold email stating that SBS would absorb disty and OEM ORT failures, John Grieci, electrical failure analysis engineer, cautioned that "**we shouldn't use SBS as a dumping ground**." *See* FED_SEAG0055100 (emphasis added). Apparently, this practice of dumping bad drives to retail consumers was not new to Seagate. When internally discussing Seagate's "damage control" plan for addressing the Backblaze blogs, one Seagate employee took issue with Backblaze also "tracking and continuing to report on 1.5tb Marina drives" and admitted "this was a drive we did not even release to the channel. Was so bad, it was used in Retail only . . ." FED_SEAG0009871.

[27] The Drive was first released in April 2011, and the DSP ship hold was implemented in late-May 2012. Note that the DSP predated the ST3000DM001, as it was first used in other products starting in 2010.

[28] *See* FED_SEAG0067917 (listing 21 stop ship orders as of October 24, 2012 that were either "newly created," "newly closed," "pending closure," or "pending approval").

[29] Adams Decl., ¶ 103

[30] This ship hold was for OEM Drives, indicating that not only was there a problem, but that Seagate did not put a stop to Drive shipments to the disty or SBS channels.

- FED_SEAG0058176, at 58180: Dated April 16, 2013, showing that thermal voltage margin testing revealed a 5.56% failure rate vs. 3.33% trigger limit for the Grenada BP, and the number of shipped drives was 219,889. This ship hold was mentioned above.

- FED_SEAG0057749: Dated March 4, 2014, showing Grenada BP drives being put on shipping hold. The number of shipped Drives is not indicated, but 200,000 drives were affected.

- FED_SEAG0056387: Dated June 16, 2015, showing Grenada BP2 (among other Drives) being placed on ship hold for contamination issues.

19. Additionally, it should be noted that the ship hold for the crashstop problem, discussed above, where over 152,000 drives were shipped, covered the Grenada BP as well as the Classic.[31]

20. Together with the cited documents in my opening declaration, the above collectively show that shipping holds occurred **every year** between 2011 and 2015, for a total of at least 19 ship holds. The Grenada Classic and Grenada BP were the most heavily affected, but the BP2 was also impacted. Moreover, as discussed in greater detail below, internal Seagate documents discussing the Apple recall show that Seagate shipped 850,000 Grenada BP Drives affected by a serious contamination issue to its non-OEM customers (i.e. these faulty Drives reached consumers through the disty and SBS channels). Accordingly, based solely on the shipped drive figures available, **Seagate shipped at least 1.9 million drives** that were affected by problems such as bad parts and contamination that later led to ship holds or a third-party recall.

Type of Drive	Date of Ship Hold	Number of Drives Shipped
Grenada Classic	January 2012	303,000
Grenada Classic	February 2012	320,025 (potentially millions)
Grenada Classic	July 2012	145,000
Grenada Classic	August 2012	152,000
Grenada BP	April 2013	219,889
Grenada BP	N/A	850,000
	Total:	**1,989,914**

***Figure 2*: Number of shipped drives affected by problems that led to a ship hold.**[32]

[31] FED_SEAG0016862, at 16864.

21. Notably, this estimate of defective drives shipped to consumers is only related to six of the nineteen ship holds that I have had the opportunity to review. There may be more than nineteen ship holds for the ST3000DM001 and, since some ship hold documents do not contain data reporting the number of shipped drives (or the data is incomplete), the actual number of shipped drives is likely substantially higher than the above, perhaps by millions. Accordingly, Adams' argument that the ORT AFR data is irrelevant because no adversely affected Drives were shipped to consumers is not only misleading but downright false.

21. Relatedly, it appears that Seagate's trigger limit for implementing a ship hold based on AFR was 1%.[33] However, as discussed below, Seagate advertised the AFR as 0.34% for a period of 13-15 months. Yet, I have seen no indication that Seagate changed its trigger limit to 0.34%, thus Seagate would not have put a ship hold in place for Drives that exceeded the advertised AFR of 0.34%, which is three times less than 1%.

22. Moreover, the fact that Seagate issued at least 19 ship holds for the Drive, at least 13 of which occurred between June 2011 and August 2012 alone, is astonishing. Adams attempts to portray the ship holds as Seagate merely doing its job in preventing defective Drives from reaching consumers, and he contends that ship holds "are not evidence that flawed or high AFR drives reached consumers; they are the opposite."[34] The fact that faulty Drives did reach consumers, along with the fact that over a dozen ship holds were implemented in a one-year

---

[32] As discussed above, there was another Stop Ship Order instructing the factories to "[d]owngrade failed drives to Disty and SBS," but the number of downgraded Drives that were shipped is not apparent from the documentation. It should also be noted that the foregoing figure represents only the number of drives that Seagate identified as being affected by the specific problems that ultimately led to a ship hold. In some instances, it was unclear from the ship-hold documents how many of the shipped drives were for other capacities or how many were shipped internationally as opposed to domestically. Conversely, the figure does not account for affected drives that were sold to consumers through the disty or SBS channel in instances where the ship hold was only for OEM drives and does not account for drives that were released from a ship hold when the AFR was still too high or drives that Seagate did not issue a ship hold for.

[33] *See* Figure 3, below. The horizonal orange line on the graph is at 1% and is labeled "UCL." UCL stands for upper control limit.

[34] Adams Decl., at ¶ 29

period, with additional ship holds thereafter, is remarkable because it indicates serious recurring problems with the Drive.[35]

2. For a Single Contamination Issue Alone, Seagate Shipped at Least 850K Affected Drives

23. Unsurprisingly, in his report, Adams spends little more than a paragraph addressing the Apple recall. This lapse is undoubtedly because Adams cannot dispute that a massive amount of contaminated Drives were shipped to consumers. As set forth in my opening declaration, in March of 2015, Apple became concerned with the Drives' increasing rate of return and demanded that Seagate perform a failure analysis.[36] Seagate itself was seeing a similarly high yearly return rate and was aware that the root cause was contamination that occurred during its manufacturing process.[37] In fact, Seagate changed the design of a critical hard drive component, the air bearing surface of the recording head, as a corrective action for the contamination issue, but did not disclose the design change or the contamination problem [redacted][38]

24. The Apple recall was announced on June 19, 2015, but lacked any reference to Seagate.[39] In addition to the 130,000 affected OEM Drives, Seagate projected that there were "**850K** [3TB non-OEM] drives still in warranty that could be returned due to contamination issue."[40] Notably, Seagate's projection only considered Drives that were still in warranty, meaning that the true number of affected Drives shipped to consumers was likely **far greater than 850k**.

25. In cursory fashion and without any support, Adams attempts to dismiss the magnitude of the problem with the Drives by attempting to argue that: (1) the Drives at issue in

[35] As mentioned in footnote 28 and its accompanying text, there may have been additional ship holds. For instance, FED_SEAG0067917 suggests that there were at least 21 ship holds that had been put in place for the Grenada by October 2012.

[36] FED_SEAG0057214, at 57215.

[37] FED_SEAG0057214, at 57215; FED_SEAG0057123, at 57127.

[38] FED_SEAG0057214, at 57215.

[39] FED_SEAG0002673, 2675

[40] FED_SEAG0055784, at 55785.

the Apple recall are irrelevant; (2) contamination problems only affected Drives manufactured prior to May 2013; (3) return rates are not a reliable indication of failures; and (4) no other OEMs issued recalls or reported problems with the Drives.[41] All four points fail.

26. Preliminarily, it should be noted that Adams ignores the fact that the Drives affected by the contamination issue that led to the Apple recall were Grenada BP, which contradicts his overarching (erroneous) argument that there is a dearth of evidence pertaining to problems with that Drive version. Moreover, Adams implies that the contamination problem is irrelevant when he states that "drives sold to OEMs such as Apple are not at issue in this case."[42] While this is a technically true statement, it is deceptive. The Apple recall itself applied only to OEM Drives sold to Apple, which Apple put in some of the computers it sold. However, as discussed above, Seagate sold at least 850,000 non-OEM (i.e. disty/SBS) Drives that were manufactured at the same time as the OEM Drives and affected by the *same* contamination problem,[43] and Seagate never issued a recall for them.[44] These are precisely the Drives that are at issue in this case.

27. The Apple recall affected Grenada BP Drives with contamination issues and manufactured prior to May 2013. However, major contamination issues were not limited to the Grenada BP or this timeframe, but were rather a constant issue throughout the class period and across all iterations of the Drive.

28. For example, as discussed above, in July 2012, a ship hold was placed on the Drives, and Seagate employee John Grieci expressed serious concerns about how often the Grenada Classic exceeded ORT trigger limits and observed that Seagate is "not managing quality."[45] In response to Mr. Grieci's email, another Seagate employee wrote that the trigger

---

[41] Adams Decl., at ¶ 106.

[42] Adams Decl., at ¶ 23

[43] FED_SEAG0055784, at 55785.

[44] The seriousness of the contamination issue leading to the Apple recall is demonstrated not only by the fact that at least 850,000 Drives were affected, but by the fact that, as observed by a Seagate employee in an internal email, contamination-related failures were "dominat[ing] BP" ORT. *See* FED_SEAG0057538.

[45] FED_SEAG0060976, at 60978.

"seems to be related to particle contamination."[46] The employee continued, **"At a higher level, Grenada triggers are mainly due to head instability and particle related issues."[47]** Similarly, Joni Clark, Global NAS Segment Manager at Seagate, later stated in an internal email that the Grenada had "contamination issues that caused them to fail much faster and more."[48] Thus, Seagate employees explicitly acknowledge that contamination was a major problem for the Grenada.

29. Consistent with these acknowledgments, Seagate identified contamination as one of the major root causes of the Grenada Classic's high ORT AFR (up to 2.21% and trending higher) during the 12-week period ending in early February 2012, which is discussed more fully in Section III-b., below.[49] Moreover, as of October 2012, at least six ship holds had been put in place due to contamination problems,[50] and, in a report dated September 3, 2012, Seagate identified "NHK particulate contamination" as one of three "[f]ield and supply disruption issues" plaguing the Grenada.[51] Thus, as Adams appears to acknowledge, it cannot be denied that contamination was a rampant issue for the Grenada Classic and Grenada BP Drives manufactured prior to May 2013.

30. But, contrary to Adams' contention, the contamination problem was not limited to Drives manufactured prior to May 2013. As a result of Seagate's awareness that its manufacturing process was flawed and that the Drive was released prematurely, in or around March 2013, Seagate implemented an aggressive "contamination improvement plan" that included broad changes to Seagate's cleanliness and contamination control policies, from handwashing and equipment cleaning procedures to modifications of factory equipment.[52] These

---

[46] *Id.* at 60976.

[47] *Id.* "Particle related issues" is another way of saying "contamination."

[48] FED_SEAG006071, at 6072.

[49] FED_SEAG0009670, at 9678.

[50] *See* FED_SEAG0067917.

[51] FED_SEAG0055831, at 55841.

[52] *See* FED_SEAG0026577, at 26618-26646.

changes were significant, and they indicate that Seagate considered the severity and scope of its contamination problems to be substantial.

31. Despite the changes, contamination-related Drive failures continued to be a significant issue. For example, when Seagate conducted pre-release AFR testing for the Grenada BP2 in or around January 2014, the top issue it identified was related to contamination.[53] The corrective actions Seagate implemented to lower contamination to an acceptable level post-release were obviously not effective, as evidenced by the fact that Grenada BP2 contamination-related failures were used as examples in an internal Seagate document explaining why further improvements needed to be made to Seagate's contamination protocols.[54] This document, which was dated May 20, 2014 and which focused on drive head contamination, reported that 52 Grenada BP2 Drives in Seagate's failure analysis tracking system had head and head gimbal assembly issues.[55] Out of the nine Drives that underwent further analysis, six showed "evidence of actual or potential head or slider contamination and/or damage."[56] Moreover, to the extent that Seagate implemented any further changes to its contamination protocols, it is apparent that they were not effective, as a ship hold was placed on the Grenada BP2, among other Drives, for contamination issues on or around June 16, 2015.[57] In light of the foregoing, Adams' contention that contamination issues were limited to Drives manufactured before May 2013 is incorrect.

32. Likewise, Adams' argument that "return rates are not a reliable indication of failures" is erroneous and directly contradicted by Seagate's internal treatment of return rate data. The "Seagate Acronym Dictionary", which is characterized by Seagate as "The definitive source for acronyms and terms at Seagate", defines "ARR", "Average Rate of Return", and "Annualized Return Rate" as "a **measure of product reliability** and is usually based on end user percentage of drives returned to the Company; **reflects product quality and reliability**."[58]

---

[53] FED_SEAG0057277, 57324.

[54] FED_SEAG0056914.

[55] FED_SEAG0056914, at 56918.

[56] *Id.*

[57] FED_SEAG0056387.

[58] FED_SEAG0055171 at 55173.

33. Customers will return drives to the manufacturer for a variety of reasons. In my experience, the most common reasons for customers to return their drives are: (a) the drive has failed; (b) the drive does not function properly due to mechanical, electrical, interface or software related issues; or (c) the customer does not understand how to use the drive. A certain percentage of drives that are returned will be designated No Trouble Found ("NTF") because, after examining the drive, a manufacturer, such as Seagate, could not find an issue with it. Thus, in general, the Annual Return Rate ("ARR") observed by a manufacturer will often be higher than the Annual Failure Rate ("AFR"). However, there are three important caveats:

a. A drive that is marked as "NTF" may have in fact failed for the customer. This can happen with transient or intermittent failures. This class of failures is real and extremely difficult to diagnose. A good example is the firmware bug associated with a floating diagnostic port, as discussed in the Hospodor Declaration, that could cause a drive to report "Not Ready" on an intermittent basis.[59] Although these failures are real, Seagate does not consider them in its analysis. Indeed, an internal Seagate document indicates that Seagate realized that its NTF classifications were not necessarily accurate.[60]

b. Drives that are out of warranty will not normally be returned by the consumer (at their expense) nor accepted by the manufacturer. Thus, the ARR does not account for the failures beyond the warranty period. At times, Seagate's warranty on the Drives were as short as one or two years,[61] even though Seagate designed the Drives with an expected service life of five years.[62]

c. Not all drives that fail within the warranty period will be returned. A consumer may opt not to return the failed drive because of the hassle or expense involved, or because the delay in getting a replacement drive is too long. Customers with highly confidential information on the drive would also be unlikely to return their drives to Seagate. Common sense indicates that a considerable number of failed drives will not be returned.

34. Finally, Adams' contention that no other OEMs "reported problems with the Drives" is belied by the evidence. As set forth in the Hospodor Declaration, [redacted]

[redacted]"

[59] Hospodor Decl., at ¶¶ 164, 185.

[60] *See* FED_SEAG0015884 ("need to formalize a process and cadence around sending products here to Cupertino for FA. Example would be Go Flex home where NTF classification may not be totally accurate.")

[61] *See* FED_SEAG0016461

[62] *See* FED_SEAG0056259, at 56262.

B. Post-Release Testing Reveals that the AFR was Consistently Higher than the Advertised AFR

35. In his attempt to obfuscate, Adams ignores that post-release testing of the Drives reveal that Seagate was aware that the Drives were unreliable and had an AFR that was higher than industry standard. Adams criticizes the Hospodor declaration for "citing only two documents containing AFRs over 1% for internal (Disty) drives" that "both relate to Grenada ***Classic*** drives ***in 2012*** that were not being shipped to consumers at the time" and that there is "no evidence that Grenada BP or Grenada BP2 drives had AFRs over 1%."[65] Apparently, Adams did not realize that the Hospodor Declaration was not meant to provide an exhaustive list of the many examples of ORT AFR values above the 1% threshold. He also apparently did not see fit to

[63] FED_SEAG0024743, at 24763.

[64] FED_SEAG0054737. Internally, Seagate employees acknowledged "**we need to stay away from any defense on the older drives since we have no great defense in that area**." FED_SEAG0010073, at 10074 (emphasis added). In a document titled "Seagate Reliability Campaign" which appears to be an outline for Seagate's ghostwritten rebuttal articles to the Backblaze blogs, Seagate posits that one of the reasons that the Drives were so unreliable was that they "arrived post-flood amid extreme market shortage". FED_SEAG0025642, at 25646.

[65] Adams Decl., ¶ 63 [Emphasis in original].

research whether ORT AFR was above 1% for other periods, but rather simply assumed that it was not. Accordingly, I provide a more detailed picture below.

36. Seagate's ORT results show that for at least 39 weeks out of a 74-week period, the projected AFR was >1% (and by extension dramatically higher than the AFR of 0.34% that Seagate advertised for over a year). Furthermore, the ORT data show that Seagate's attempts to fix the underlying problems were largely unsuccessful and, as discussed above, that large numbers of affected drives were shipped to end users.

37. For instance, as discussed in the Hospodor Declaration, a post-release ORT document dated February 7, 2012 reveals that the AFR for the ST3000DM001 was above 1% for **12 weeks straight** and was getting worse.[66] Specifically, it climbed to 2.21% in the 12th week. It is important to note that these results are for the internal Drive, but they are also germane to the external Drives because the ST3000DM001 that is sold as an internal Drive is used in the external Drives; Seagate did not maintain separate production lines or processes for SBS and Disty products, or even OEM products.[67] The graph cited in the Hospodor Declaration is reproduced below.

[66] FED_SEAG0009670, at 9681.

[67] *See* Dewey Decl., at ¶ 8 ("Seagate did not build different ST3000DM001 drives for SBS, disty and OEM channels.")

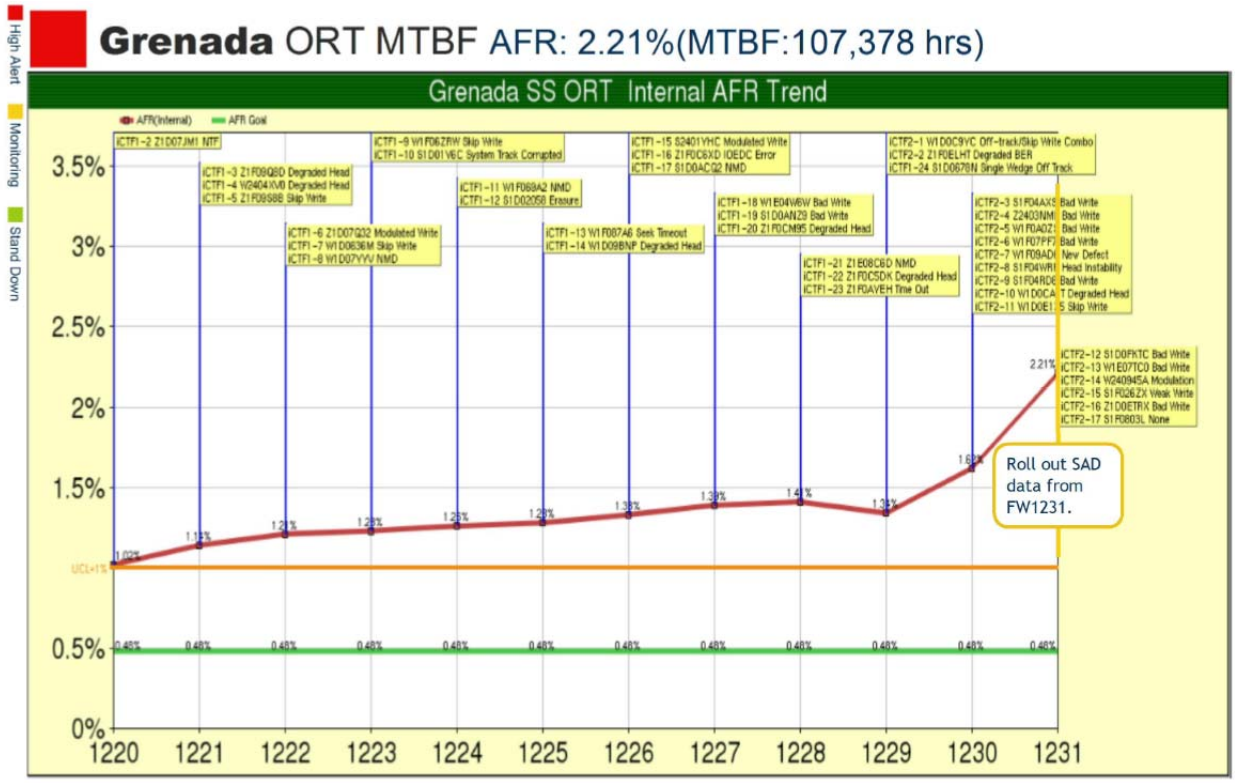


Figure 3: **Grenada 12-week ORT Chart. FED_SEAG0009670, at 9681.**

38. Adams attempts to minimize this data by characterizing it as only for a "few weeks." I am not sure why Adams considers three months to be only a few weeks. Nonetheless, it is worth stressing that Netel declared that an AFR above 1% would trigger a ship hold until corrective action was identified and implemented.[68] If he is correct, then during the first work week on the above graph, where the AFR was 1.02%, a ship hold would have occurred, corrective action taken, and production resumed. Given that ORT is a rolling 6-week test,[69] I would have expected the AFR rate to have continued to rise for a week or two as the bad Drives propagated through the test procedure, and then for the AFR to rapidly decrease as the Drives with the implemented fixes started flowing through ORT. Instead we see the AFR continuing to rise, showing that the supposed fixes were failing to solve the problems, or that additional problems were occurring.[70]

---

[68] Netel Decl., at ¶ 19.

[69] Netel Decl., at ¶ 11.

[70] Adams also claims that the data on this graph represents the "raw" AFR. Adams Decl., at ¶ 66. There is nothing in the graph that indicates whether the plotted data are "raw" AFR or "reduced" AFR, so the basis for Adams' assertion is unclear. But even if it is the raw AFR, the

39. Seagate's AFR goal is represented by the green line and was 0.5%. The trigger limit (labeled UCL for "upper control limit") is represented by the orange line and was 1%. By financial week ("FW") 1231 (week 31 of 2012), the AFR climbed to 2.21%, which was substantially higher than the advertised AFR, 4.4 times higher than Seagate's goal, and 2.21 times higher than the trigger limit, and it was on a trajectory to go higher. Indeed, the AFR did increase further. An internal Seagate quality report dated March 6, 2012, which was four weeks beyond the ORT chart shown in Figure 3, stated that the 12-week rolling AFR average was 2.25%.[71]

40. As discussed in the Hospodor Declaration, a June 2012 Grenada Classic ORT document also revealed an AFR substantially greater than the advertised rate. Unlike other ORT documents, there was no 12-week graph associated with this ORT, but rather a table stating the AFR and the reduced AFR projection. The relevant portions are shown below:

Grenada ORT FE Table 6/4/20

Grenada Classic ORT — Updated: 6-4-12 12:00 AM

AFR (1st year Weibull)	3.436%	From all fails Weibull MLE	No_Info	QTY_TESTED
MTBF (1st year Weibull)	68645.4			
Minimum AFR:	0.021%	From zero fail Weibull @ 50% CL	2400	POH/Year
Total Number of Failures	81		0.506781	Weibull Beta
AFR for 1 failure	0.042%	AFR decrease per failure @ 100% fix effectiveness	535	Average Test Hours

Issue	Corrective Action	Fix Validation	# of Failures	% Fail	Eff. Factors Demo'd	Eff. Factors Potential	Reduced AFR Demo'd	Reduced AFR Potential	PFL/TTF
SPPL-167: NMD - Post SAD - NHK Suspension		Validation based on reducing the NHK loading to 30% through July	10	0.422%	40%	70%	3.267%	3.141%	PFL-4266/530,PFL-4354/324,PFL-4271/52,PFL-4268/198,PFL-4217/531,PFL-4305/37,PFL-4148/642,PFL-4175/46,PFL-3896/143,PFL-4161/10
SPPL-121: CND retest pass!			6	0.253%	100%	100%	3.183%	3.183%	PFL-4188/23,PFL-3859/149,PFL-4147/294,PFL-3923/328,PFL-4119/263,PFL-3899/12
SPPL-172: Aborted Write due to Power Reset - Test Equipment Related			1	0.042%	100%	100%	3.394%	3.394%	PFL-4267/376
SPPL-173: unqualified material escaped to mass production			1	0.042%	0%	100%	3.436%	3.394%	PFL-4329/322
		Total Number of Fails	81			Reduced AFR:	2.35%	1.79%	
						Corresponding MTBF:	100K	132K	

Figure 4: **Grenada Classic ORT, FED_SEAG0026751, at 26785**

41. As indicated by the table, ORT revealed a raw AFR of 3.436%, which is over ten times greater than the 0.34% AFR Seagate was advertising at the time. Adams contends that raw AFR does not represent the AFR of Drives being shipped to consumers because the Drives were on ship hold and raw AFR does not take into account fixes Seagate devised for the Drives. As

---

data shows that the corrective action taken by Seagate was not effective, as the AFR continued to rise.

[71] FED_SEAG0063104, at 63107.

discussed above, however, Adams' argument is premised on the false assumption that Seagate's ship holds prevented any affected Drives from reaching consumers. And, in any event, the reduced AFR, which was the post-fix AFR projection, was 2.35%, which is nearly seven times higher than the advertised AFR.

42. This was not an isolated incident. A Seagate document dated November 29, 2012 contains a graph showing the 12-week rolling AFR for the Grenada, as reproduced below.

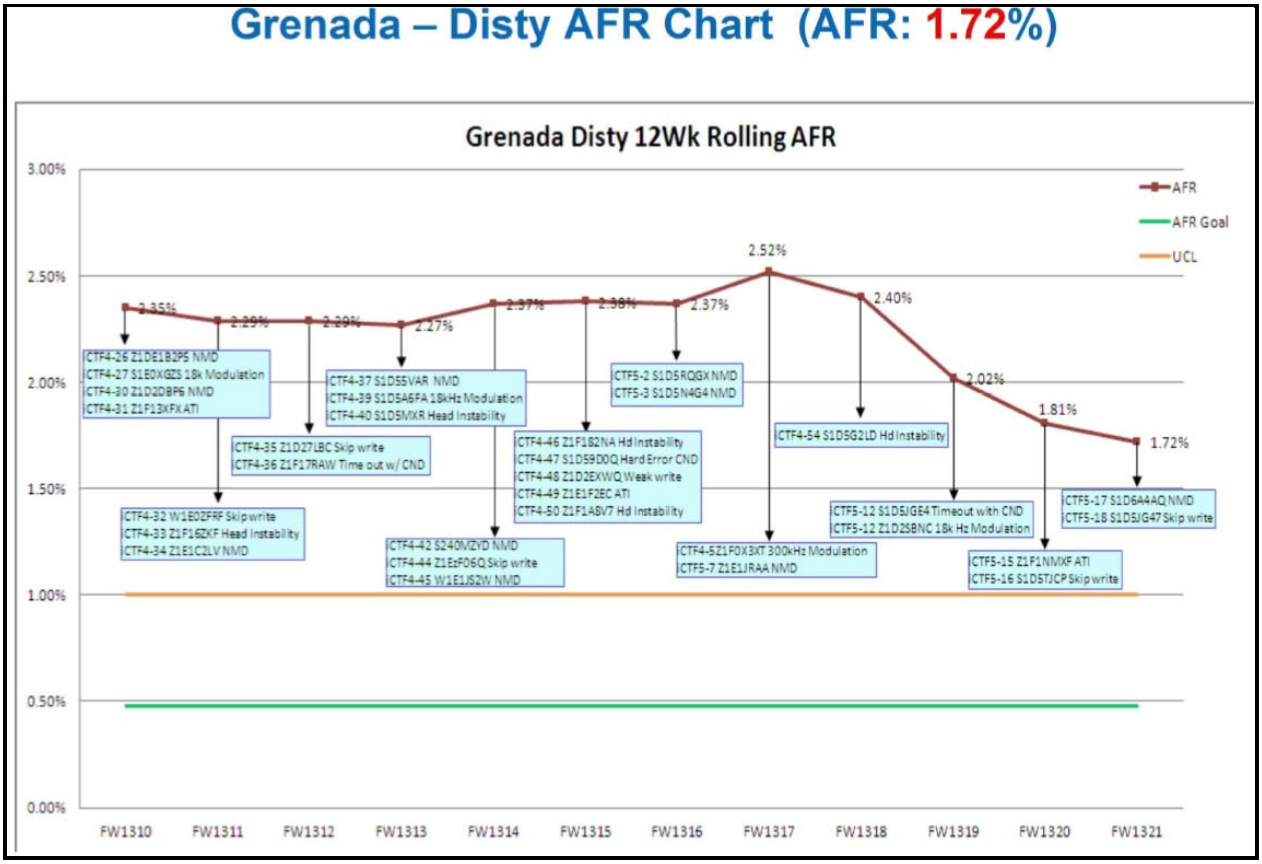


Figure 5: **Grenada Disty 12-week ORT AFR ending FW 1321. FED_SEAG0059618, at 59620**

43. The AFR was above 2% for almost the entire period, peaking at 2.52% in FW1317. The AFR then decreased to 1.72% by FW1321, showing that, in this case, at least one of the fixes was effective in reducing the AFR. However, the projected AFR is not even close to the advertised AFR of 0.34%. In fact, the AFR remained unacceptably high into 2013; an ORT document dated May 3, 2013 reveals that starting in February 2013, about two months after the above 12-week period ended, the AFR consistently exceeded the advertised AFR, peaking at 2.66%. The graph is reproduced below.

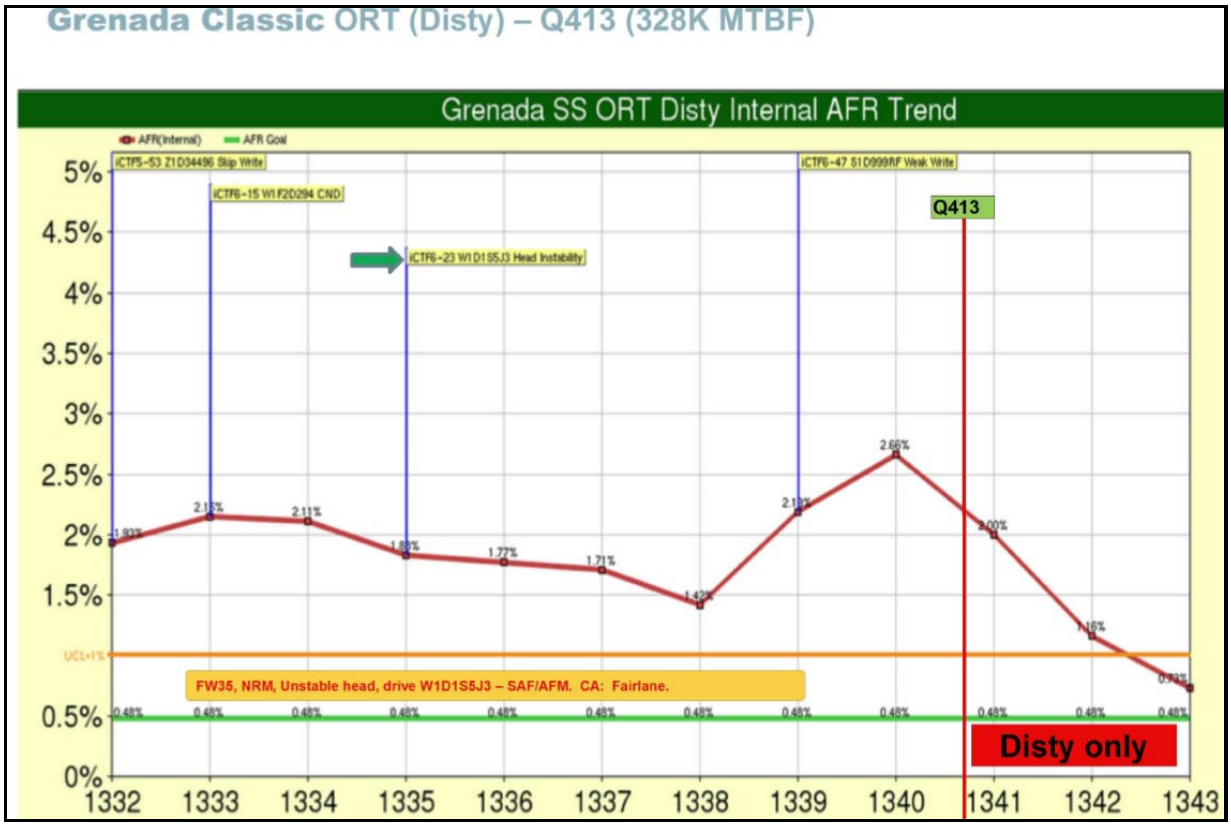


***Figure 6*: Grenada Disty 12-week ORT AFR ending FW1343. FED_SEAG0056563, at 56595**

44. As can be seen in the graph, the AFR was well above 1.5% for almost the entire period, and above 2% for 5 of the 12 weeks. The AFR then decreased to 0.73% by FW1343, showing that in this case at least one of the fixes was effective in reducing the AFR. As suggested by all of the above graphs and data, however, the fact that the AFR for the Grenada Classic dipped below 1% for one week is no guarantee that it remained there. The high rate of failures was not confined to the AFR of Grenada Classic. The Grenada BP disty ORT chart below is for the same time period as the Grenada Classic chart above.

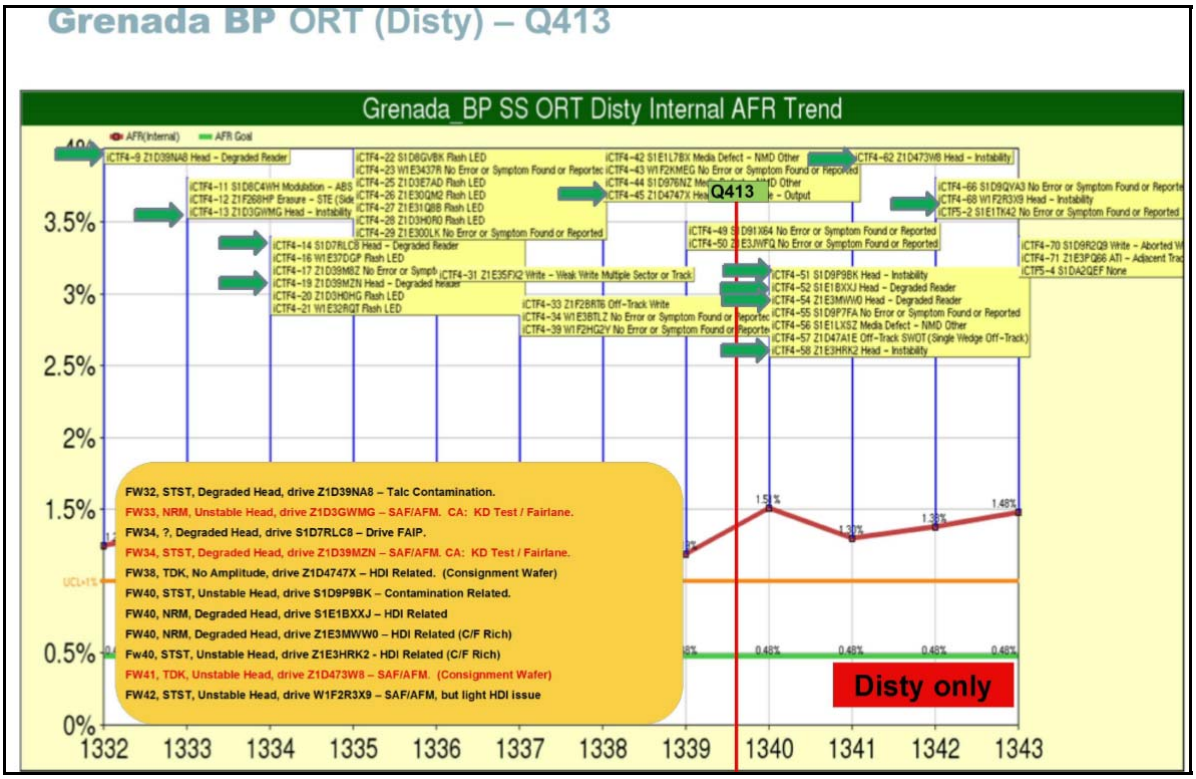


Figure 7: **GrenadaBP 12-week ORT AFR ending FW1343. FED_SEAG0056563, at 56602.**

45. For the first week, FW1332, it appears the AFR is about 1.25%, and the final 5 weeks are all well above 1% and trending higher. The remaining weeks, however, are obscured by the callout. However, it can be deduced from other charts from the same time period that the AFR was above 1% for the entire 12-weeks.

46. Below is the ORT graph for the Grenada BP disty and OEM Drives combined. All of the data points are above 1%. It is followed by a chart for the OEM Drives only. In all but one of the 12 weeks, the AFR for the OEM Drives is equal to or lower than that of the OEM and disty Drives combined, and in most weeks it is lower. Thus, it stands to reason that the disty Drives generally had a higher AFR than OEM for this period, and since all of the data points for the combined graph are above 1%, it is highly likely that the obscured data points in the disty-only graph are also above 1%.

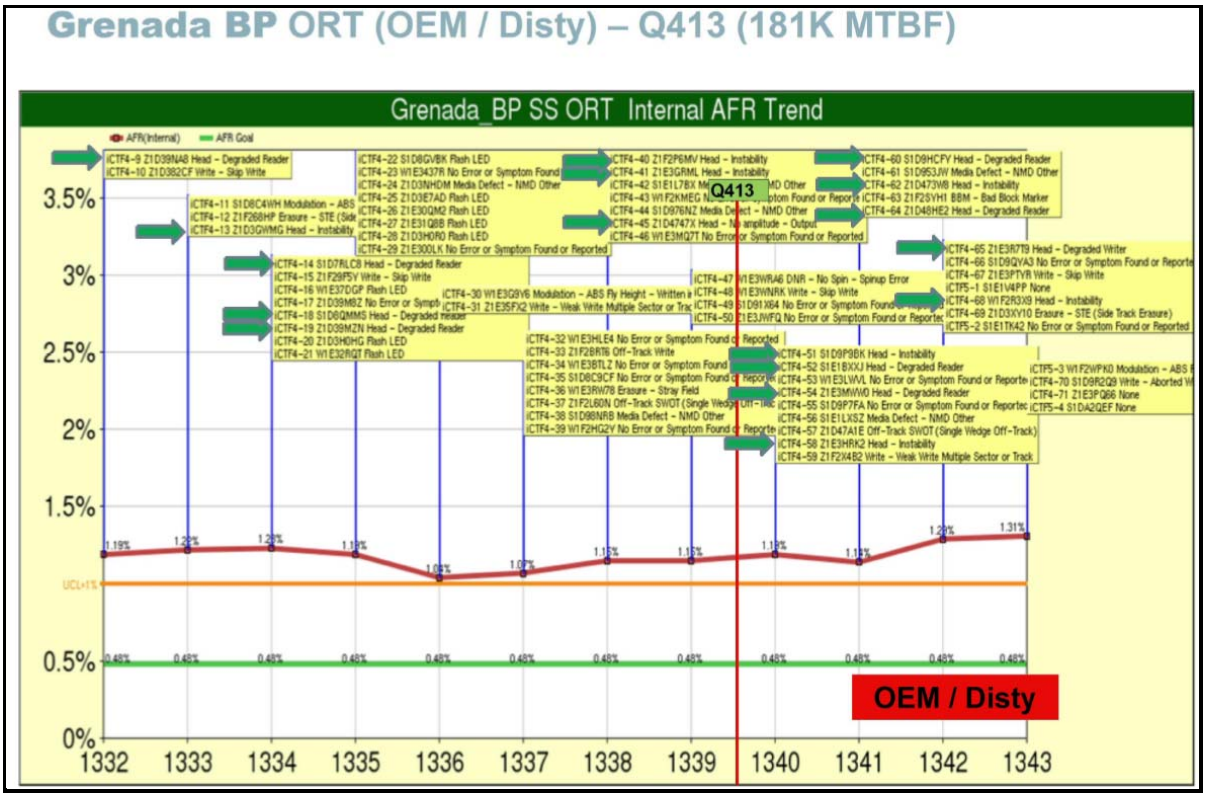


***Figure 8*: Grenada BP OEM/Disty ORT AFR. FED_SEAG0056563, at 56600**

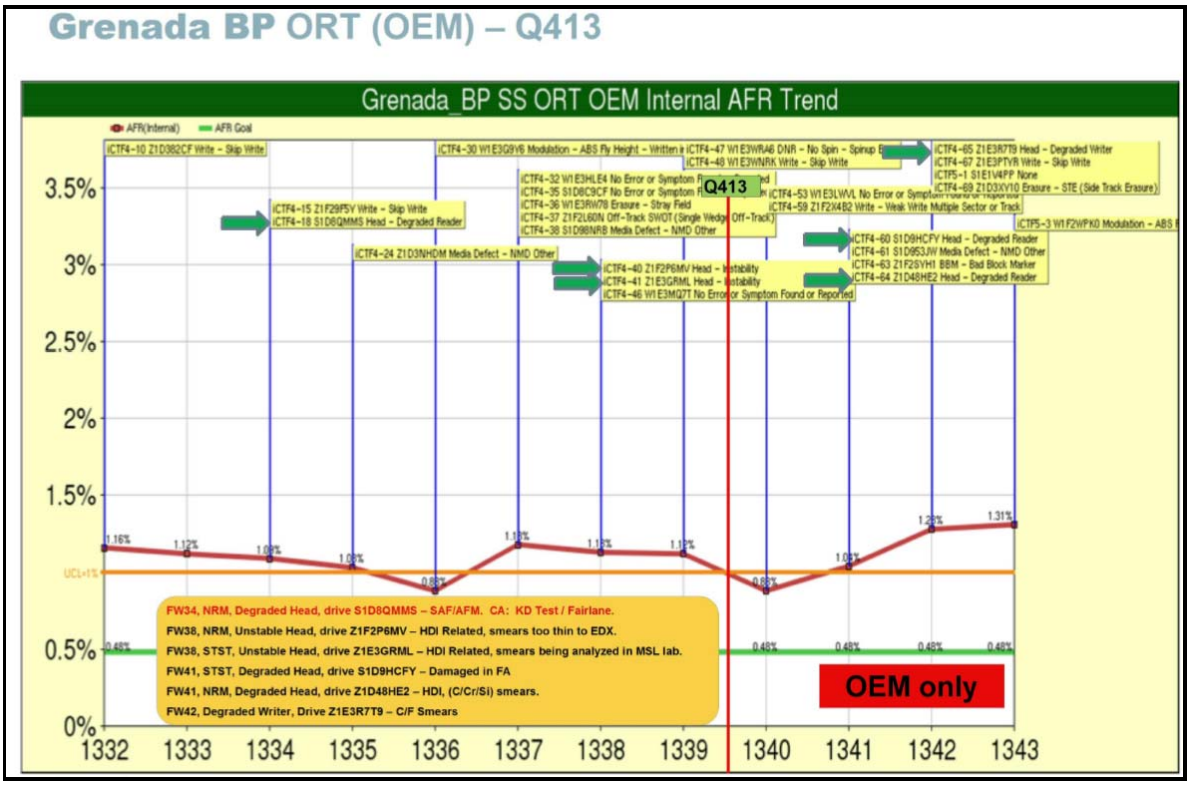


***Figure 9*: Grenada BP OEM-only 12-week ORT AFR. FED_SEAG0056563, at 56601**

47. In sum, contrary to Adams' arguments, the above data demonstrates that the ST3000DM001 suffered from ongoing issues that pushed the AFR past the advertised rate, often substantially so.

48. Adams also claims that the June 2012 ORT results, reproduced at Figure 4, are unreliable because of the combined low average number of test hours. Specifically, he speculates that "the low average number of test hours could contribute to 'noisy' or even elevated results."[72] Given that Adams spent so much energy trumpeting his statistical acumen, surely Mr. Adams must have recognized that:

a. Seagate designed the test. If the test was unreliable then they could have and should have changed the test. If the test was not sufficient, the drives could have been tested longer, but Seagate chose not to do that.

b. If the sample size is small, such that the data are "noisy," then the test results are just as likely to give suppressed results as they are to give elevated results. To only suggest an elevated result reflects poorly on Adams.

c. These test results were clearly consistent with previous test results that also show higher AFR.

49. Adams next speculates that infant mortality could skew the results into showing a higher AFR than would be shown using the full six weeks-worth of data.[73] I am not privy to the underlying statistical model Seagate used for ORT. However, I would be astonished if the model did not account for not only that a failure has occurred, but also when it occurred. In other words, the model should accommodate infant mortality. The fact that Adams speculates that this might be occurring rather than investigating the model and confirming it one way or the other is telling.

50. As discussed above, Adams also claims that the ORT results discussed in the Hospodor Declaration are irrelevant because Seagate put ship holds in place whenever ORT revealed that the Drives breached a "trigger limit." This ignores the fact that Seagate advertised the AFR as 0.34% for a substantial portion of the Class period, yet the AFR trigger limit was

[72] Adams Decl., at fn. 20.

[73] *Id.*

1%. Moreover, as discussed at length herein, Adams' contention that ship holds prevented affected Drives from reaching consumers is wrong.

C. The True AFR was Higher than Projected by Seagate and the AFR was Increasing

51. It is important to keep in mind that the AFR figures discussed above are **projected** AFRs. That is, they are the result of a statistical model, which may or may not correlate well with reality. Seagate is obviously aware of this, and in the same document that Figure 3 appears, Seagate included a graph comparing the projected AFR to the actual field AFR for a different product ("Pharaoh") manufactured at the same time as Grenada. The chart is reproduced below.

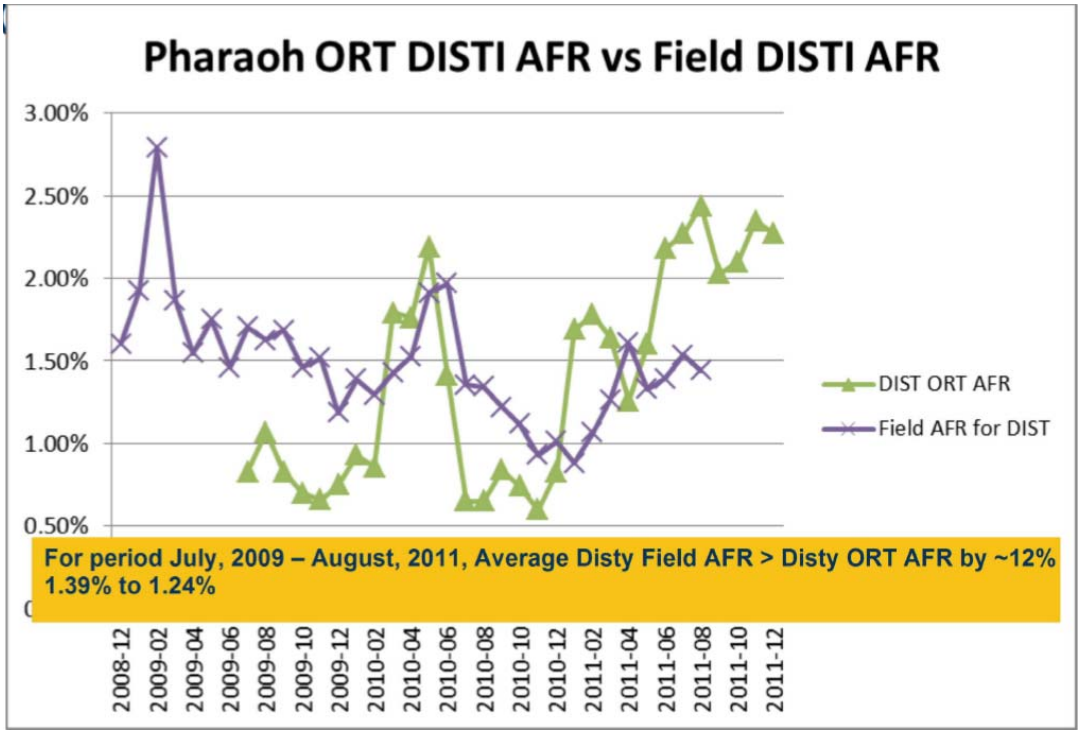


Figure 10: **FED_SEAG0009670, at 9701**

52. The green line is the projected Disty AFR from Ongoing Reliability Testing, and the purple line the actual AFR from the field. Note that the field AFR lags the projected AFR by a number of months, presumably reflecting the lag from production to end user usage. The callout states "Average Disty Field AFR > Disty ORT AFR by ~12% 1.39% to 1.24%". In other words, the field failure rate was on average 12% greater than the ORT model projection. It is not unreasonable to expect that the AFR projections for Grenada were similarly understating the actual failure rates experienced by consumers. The fact that the author of a 33-page document

titled Grenada ORT MTBF Trigger chose to include this page (which is the only non-Grenada specific page in the document) suggests that the author believes it is pertinent to assessing the projected AFR of Grenada.

D. The Backblaze Reports Evidence An Increasing, Abnormal Annual Failure Rate

53. In addition to the fact that the field AFR is higher than Seagate's projected AFR, the AFR of the Drives increased over time (i.e. as if they had a Weibull beta of >1), as the Backblaze reports make apparent. Adams criticizes the Backblaze reports by noting that Backblaze misused the Drives.[74] One criticism of the Backblaze data is that the Drives were not designed for use in a data center and that the storage pods that Backblaze mounted the Drives in were not a controlled environment and susceptible to vibration. Accordingly, I am not offering the specific failure rates experienced by Backblaze as evidence of the precise AFR of the Drives experienced by regular consumers. However, the Backblaze data does demonstrate that the ST3000DM001 was significantly less reliable than its competitors and exhibited a dramatically increasing failure rate. It should be noted that ***hard drive manufacturers, including Seagate, subject drives to extreme stress and workloads when conducting accelerated life testing to ascertain the projected AFR of a drive.*** Thus, the fact that Backblaze may have pushed the Drives beyond their limits does not invalidate my conclusions.

54. The two critical points that Adams misses in his reply declaration are that the failure rate of the ST3000DM001 at Backblaze increased dramatically over a three year period, and virtually all of the 3TB hard drives used by Backblaze, including those from other manufacturers, were used in the same type of storage pod, yet the ST3000DM001 performed markedly worse.[75] In 2013, the failure rate of the ST3000DM001 was 10.35%, and it skyrocketed to 43.08% in 2014. For the first through third quarters of 2015, the failure rate was 30.94%. At the time the Backblaze report was published, data was not yet available for the fourth quarter of 2015.

---

[74] Adams Decl., at ¶ 80.

[75] *See* Backblaze, *What Can 49,056 Hard Drives Tell Us? Hard Drive Reliability Stats for Q3 2015*, https://www.backblaze.com/blog/hard-drive-reliability-q3-2015/ (Oct. 14, 2015).

55. Such a substantial jump in failure rate, from 10.35% to 43.08%, over a one-year period is remarkable. It demonstrates that not only did the failure rate of the Drive increase over time, but it increased quickly and dramatically. This stands in stark contrast to Adams' claim that the Drive's AFR was highest in the first year and then declined.[76]

56. By comparison, the other 3TB hard drives used by Backblaze, ***which were all consumer desktop drives and were used in the same type of storage pods as the ST3000DM001***, had substantially lower failure rates and did not experience dramatic degradations of reliability like the ST3000DM001 did, as shown in the figure below.[77]

Backblaze Hard Drive Failure Rates

Ordered by Drive Size (2013 through Q3 2015)

Model Name/Number	Size	2013 Failure Rate	2014 Failure Rate	2015 Failure Rate	All Periods: 2013 - 2015 Failure Rate	Low Rate	High Rate	Max # in Service	Avg Age (Months)
HGST(*) Deskstar 5K3000 (HDS5C3030ALA630)	3TB	0.99%	0.59%	1.31%	0.92%	0.70%	1.10%	4,595	40.5
HGST(*) Deskstar 7K3000 (HDS723030ALA640)	3TB	1.01%	2.27%	2.12%	1.91%	1.40%	2.60%	1,027	45.7
Seagate Barracuda 7200.14 (ST3000DM001)	3TB	10.35%	43.08%	30.94%	28.46%	26.90%	29.60%	4,247	34.5
Seagate Barracuda XT (ST33000651AS)	3TB	6.91%	4.80%	3.55%	5.11%	3.50%	7.30%	293	42.8
Toshiba DT01ACA Series (TOSHIBA DT01ACA300)	3TB	6.93%	3.68%	2.80%	4.20%	1.40%	9.80%	58	29.1
Western Digital Red 3 TB (WDC WD30EFRX)	3TB	3.79%	6.94%	8.79%	7.65%	6.40%	9.30%	1,085	16.3
Western Digital Green 3 TB (WDC WD30EZRX)	3TB	6.32%	0.00%		6.32%	4.10%	9.80%	388	0.0
All 3TB Drives		**5.22%**	**15.06%**	**4.33%**	**9.43%**				

Figure 11: **Backblaze 3TB failure rate chart (entries for 1-2TB hard drives omitted)[78]**

57. For example, the HGST Deskstar 5K3000 had a 0.99% failure rate in 2013, which decreased to 0.59% in 2014, and then reached 1.31% in 2015. Its overall failure rate for

---

[76] *See* Adams Decl., at ¶ 41(d).

[77] The following data is from the Backblaze report cited in footnote 75, above. *See also* FED_SEAG0025567, at 25571 (internal Seagate document analyzing the Backblaze failures noting that ST3000DM001 drives have an expected workload for "Desktop, External Storage, Desktop Raid" applications and that Backblaze experienced a 43.10% AFR for 1,163 Drives in 2014).

[78] *Id.*

this period was 0.92%, which is approximately 31 times lower than the ST3000DM001's overall failure rate of 28.46%. Similarly, the failure rate for another HGST model, the Deskstar 7K3000, was 1.01%, 2.27%, and 2.12% over the same period. Its overall failure rate was 1.91%, which was about 15 times lower than the ST3000DM001's rate. By way of further example, the failure rate of the Western Digital Red was 3.79%, 6.94%, and 8.79%, with an overall failure rate of 7.65%, which was nearly 4 times lower than that of the ST3000DM001.

58. Adams claims that the Backblaze data should be disregarded because "Backblaze only used one other brand of 3TB drives in any significant numbers (HGST), while excluding 3 brands (Samsung, Toshiba, and Western Digital)."[79] This statement is misleading. First, it should be noted that Backblaze used two different types of Drives from HGST, both of which were used in significant quantities.[80] Second, while Backblaze may have excluded the results of the Western Digital Green, it did not exclude the results of the Western Digital Red, which it used in significant numbers, as can be seen in the above chart.[81]

59. Moreover, it is telling that failure rate gap between the **4TB** version of the Barracuda/Desktop HDD and the other 4TB Drives used at Backblaze is substantially smaller than the gap between the ST3000DM001 and the other 3TB Drives.

[79] Adams Decl., at ¶ 79

[80] As shown by the above figure, the maximum number of Deskstar 7K3000 and 5K3000 drives in service at Backblaze was 1,027 and 4,595, respectively. Both are sufficient quantities to draw a meaningful comparison between the reliability of these hard drives and the ST3000DM001.

[81] The maximum number of Western Digital Red drives in service at Backblaze was 1,085, per the figure above.

Backblaze Hard Drive Failure Rates

Ordered by Drive Size (2013 through Q3 2015)

Model Name/Number	Size	2013 Failure Rate	2014 Failure Rate	2015 Failure Rate	All Periods: 2013 - 2015 Failure Rate	Low Rate	High Rate	Max # in Service	Avg Age (Months)
HGST(*) Deskstar 5K4000 (HDS5C4040ALE630)	4TB	1.65%	0.91%	0.86%	1.07%	0.80%	1.40%	2,643	29.9
HGST Megascale 4000 (HMS5C4040ALE640)	4TB	3.85%	1.41%	0.70%	0.93%	0.70%	1.20%	7,092	14.0
HGST Megascale 4000.B (HMS5C4040BLE640)	4TB		0.52%	0.47%	0.50%	0.30%	0.80%	3,103	16.9
Seagate Desktop HDD.15 (ST4000DM000)	4TB	4.17%	2.58%	3.31%	3.06%	2.80%	3.30%	20,921	13.1
Seagate Barracuda XT (ST4000DX000)	4TB	1.12%	1.12%	3.73%	1.99%	0.70%	3.60%	214	23.8
Toshiba MD04ABA-V Series (MD04ABA400V)	4TB			4.80%	4.80%	1.00%	14.20%	145	5.2
Western Digital Red 4 TB (WD40EFRX)	4TB		0.00%	2.97%	1.42%	0.00%	7.90%	45	18.5
All 4TB Drives		**2.75%**	**1.88%**	**2.18%**	**2.10%**				

Figure 12: **Backblaze failure rate chart for 4TB hard drives.**[82]

60. The Seagate Desktop HDD.15 (ST4000DM000) 4TB drive was the successor to the ST3000DM001 and was in the same drive family. The overall failure rate for the ST4000DM000 was 3.06%, compared to 1.07%, 0.93%, and 0.5% for three different HGST models.[83] Thus, the failure rate for the HGST drives was 3-6 times lower than the ST4000DM000. When contrasted with the 4-31 times difference between the ST3000DM001 and the other 3TB models discussed above, it is apparent that the ST3000DM001 was an abnormally unreliable Drive that was far less robust than its competition.

E. Adams Ignores Key Documents Showing That Seagate Falsely Marketed The Drives Throughout The Class Period

1. Seagate Advertised the AFR as 0.34% and below 1% during the Class Period

61. The Adams Declaration mischaracterizes the Hospodor Declaration and misrepresents the extent to which Seagate marketed the Drives as being highly reliable with a low failure rate. To support his contention that Seagate did not falsely advertise the AFR of the

[82] *Id.*

[83] The other 4TB drives on the chart were not used in sufficient quantities to draw a reliable comparison to the ST4000DM000.

Drives, Adams argues, "The evidence Hospodor cites indicates that, at most, Seagate published a 0.34% AFR for the internal, desktop products for approximately 4 months."[84] This is a mischaracterization of the evidence in the Hospodor Declaration. As outlined in that declaration, Seagate advertised the AFR on its website as "0.34%, <1%" or "0.34%" for a 13-15 month period.[85] Moreover, the AFR was advertised as 0.34% in the April 2011 Product Manual.[86]

62. To downplay Seagate's omissions and the misrepresentations published on Seagate's website, Adams and Fochtman claim that Seagate's advertisement of the Drive as "0.34%, <1%" on the webpage "clearly combined information for many different drives."[87] I have reviewed numerous archived versions of the webpage from different time periods, and none of them contain any statement that the above AFR figure references different drives, and the only consumer desktop hard drive listed on Seagate's website at this time was the Barracuda, although it was offered in different capacities. Since "0.34%" is not inconsistent with "<1%" in the sense that 0.34% is, in fact, less than 1%, a consumer would reasonably expect the 0.34% AFR listed to be that of all the Drive capacities, including the ST3000DM001.

63. On a *separate* "specifications" webpage, the AFRs for the different capacities of the Barracuda are listed. Here, some drives are listed as having an AFR of <1%, and some are quoted as 0.34%. However, beginning in November 2013 at the latest, the AFR for the 3TB capacity was blank, as shown below:

[84] Adams Decl., at ¶ 16(b).

[85] *See* Hospodor Decl. at ¶¶ 53-54.

[86] Adams and Schweiss claim that this Product Manual was a draft that was never released to consumers, conveniently ignoring the fact that Seagate disseminated the Product Manual with the .34% AFR specification to its consumers, as evidenced by the fact that the version produced by Seagate during discovery was an attachment to an email that Seagate sent to a consumer. FED_SEAG0019041.

[87] Adams Decl., at ¶ 53, n. 17; Fochtman Decl., at ¶¶ 9-10.

Generation	7200.14									
Capacity	3TB	2TB	1.5TB	1TB	750GB	500GB	320GB	250GB	1TB	750GB
	Show me : What's Different | What's the Same									
Form Factor	3.5"	3.5"	3.5"	3.5"	3.5"	3.5"	3.5"	3.5"	3.5"	3.5"
Interface Options	SATA 6Gb/s	SATA 6Gb/s	SATA 6Gb/s	SATA 6Gb/s	SATA 6Gb/s	SATA 6Gb/s	SATA 6Gb/s	SATA 6Gb/s	SATA 6Gb/s	SATA 6C
Performance										
Spindle Speed (RPM)	7200	7200	7200	7200	7200	7200	7200	7200	7200	7200
Cache (MB)	64	64	64	64	64	16	16	16	32	32
Transfer Rate, Max Ext (MB/s)	600	600	600	600	600	600	600	600		
Sustained Data Rate OD	210MB/s	210MB/s	210MB/s	210MB/s	210MB/s	125MB/s	125MB/s	125MB/s		
Average Latency (ms)	4.16	4.16	4.16	4.16	4.16	4.16	4.16	4.16	4.16	4.16
Reliability/Data Integrity										
Nonrecoverable Read Errors per Bits Read	1 in 10^{14}	1 in 10^{14}	1 in 10^{14}	1 in 10^{14}	1 in 10^{14}	1 in 10^{14}	1 in 10^{14}	1 in 10^{14}		
Annualized Failure Rate (AFR)		<1%	<1%	<1%	<1%	<1%	<1%	<1%	0.34%	0.34%

Figure 13: **Barracuda specifications webpage, as it appeared on November 2012.[88]**

I do not believe this omission was accidental, as the 3TB Drive's AFR was blank for the December 2012 and January 2013 specification pages as well.[89] Omitting the AFR for one drive capacity while including it for other capacities in the same drive family is anomalous and indicates that there is a problem with the omitted drive. In my experience, hard drive manufacturers are eager to tout the AFR of their drives if they are less than 1% because it is a benchmark of drive reliability. If the AFR of the 3TB Drive had been 0.34%, or even <1%, Seagate surely would have included it alongside the specifications for the other capacities, and its omission further demonstrates that Seagate knew that the AFR for the 3TB Drive was higher. As discussed in the preceding sections, internal Seagate documents confirm that this was the case.

---

[88] Seagate, *Barracuda Desktop Hard Drive*, https://web.archive.org/web/20121107201536/http://www.seagate.com/internal-hard-drives/desktop-hard-drives/barracuda/ (archived Nov. 7, 2012) (click on "Specs").

[89] Seagate, *Barracuda Desktop Hard Drive*, https://web.archive.org/web/20121209052449/http://www.seagate.com/internal-hard-drives/desktop-hard-drives/barracuda/ (archived Dec. 9, 2012) (click on "Specs"); Seagate, *Barracuda Desktop Hard Drive*, https://web.archive.org/web/20130101172949/http://www.seagate.com/internal-hard-drives/desktop-hard-drives/barracuda/ (archived Jan. 1, 2013) (click on "Specs").

64. Thus, it is my opinion that, despite knowing that the AFR of the 3TB was higher, Seagate chose to misleadingly quote the AFR as "0.34%, <1%" on the main "Desktop Hard Drives" page (hereafter, "main page") without informing the consumer that it was a combined statistic or that it did not apply to the 3TB Drive, which was Seagate's newest desktop hard drive.[90] Moreover, by September 2013 at the latest, Seagate removed all references to AFR on the specification page, while quoting the AFR on the main page as just "0.34%."[91]

65. The fact that Seagate advertised the AFR of the Drive as 0.34% (or "0.34%, <1%") on the website and in the Product Manual is significant. Adams claims that, despite having raw AFRs of over 1%, the pre-release AFR testing for the "disty" Drives contained reduced AFR projections ranging from 0.90% to 0.98%, and as such, Seagate's AFR representations to consumers were allegedly accurate even though the projected failure rate was nearly three times the advertised AFR. Adams ignores two critical points: 1) the Grenada Classic and Grenada BP were released and sold when the AFR was being advertised by Seagate as 0.34%; and 2) post-release ORT revealed a projected AFR that was frequently above 1%, as discussed above.

66. The difference between the advertised AFR and the AFR projected by Seagate during testing is not trivial. A drive population with a projected AFR of 0.98%, for example, is expected to incur nearly three times more failures than a population with a projected AFR of 0.34%. Moreover, as discussed in the Hospodor Declaration and above, ORT testing conducted in June 2012 projected a "raw" AFR of 3.436% and a "reduced" AFR projection of 2.35% for the Grenada Classic. This testing occurred during the time the AFR was advertised as 0.34%. A

---

[90] *See, e.g.* Seagate, Desktop Hard Drives, https://web.archive.org/web/20121123050530/http://www.seagate.com/internal-hard-drives/desktop-hard-drives/ (click on "specifications" tab) (archived Nov. 23, 2012) (example of advertisement on the main page).

[91] Seagate, *Desktop Hard Drives*, https://web.archive.org/web/20130911084603/http://www.seagate.com:80/internal-hard-drives/desktop-hard-drives/ (click on "Specifications" tab) (archived September 11, 2013) (advertising AFR as 0.34%); Seagate, *Desktop HDD,* https://web.archive.org/web/20130914024325/http://www.seagate.com:80/internal-hard-drives/desktop-hard-drives/desktop-hdd/ (click on "Specs") (archived Sept. 14, 2013) (specification page containing no AFR figures for the different capacities).

hard drive population with a projected AFR of 3.436% or 2.35% is expected to experience approximately ten times or seven times more failures, respectively, than a population with a projected AFR of 0.34%. This difference is material because, unlike many consumer products, when a hard drive fails, the consumer does not just lose the product itself, but they also lose all their personal data, work documents, and everything else they have stored on it, and recovering the data can cost thousands of dollars.

2. Drives were Marketed as Reliable Throughout the Class Period, but Were Highly Unreliable

67. Adams argues that because Seagate did not advertise the AFR for its external SBS Drives, the higher-than-normal AFR and high failure rates for the Drives are irrelevant. However, it is my understanding that this case also involves Seagate's failure to disclose that the ST3000DM001, shipped to consumers as both internal and external storage, had a high AFR and was unreliable. The reduced AFR projections calculated by Seagate during pre-release testing for the Grenada SBS and Grenada BP SBS external drives, 2.34% and 2.0%, respectively – are high and would be a cause for concern among consumers.[92]

68. Adams characterizes the external drives at issue in this litigation as "standalone backup storage devices" and contends that Seagate's decision to design those Drives to be used for only two hours a day of use was reasonable for these products because they are "meant for backup purposes."[93] Adams further asserts, "It would be difficult to use them for anything else, such as running a computer's operating system or acting as the primary data store for a computer."[94] This erroneous statement makes clear that Adams is not familiar with the type of external Drives at issue in this litigation, and that he is not familiar with consumer operating environments. Consumers are not limited to using an external drive as a backup device. In fact, an external drive can be configured as USB storage device on both PC and Macintosh computers and used as the primary storage device. Adams appears to be unfamiliar with the concept of

[92] FED_SEAG0026697, at 26704-26705 (Grenada SBS); FED_SEAG0026867, at 26887 (Grenada BP SBS).

[93] Adams Decl., at ¶¶ 12, 44.

[94] *Id. at* ¶¶ 44.

"boot priority" where a computer is simply configured to boot directly from a USB attached device and treat it as primary storage.

69. Seagate's External SBS Drives were not marketed exclusively for backup. For example, the GoFlex Home was marketed as a home server and advertised as a "network storage system" that connected to the consumer's WiFi router.[95] It "automatically and **continuously**" backed up files from multiple computers and allowed consumers to access files from the GoFlex "from **every computer** in the home" and from computers and mobile devices over the internet.[96] Moreover, the GoFlex home could stream media, such as movies, to game consoles, computers, and other devices.[97] Such an application could not possibly be characterized as occasional use and, given the fact that the GoFlex Home was promoted as a home server, consumers very likely used the device for substantially more than 2 hours a day (only 730 hours a year).

70. Likewise, the Expansion Desk, which is another external SBS Drive using the ST3000DM001, was not marketed by Seagate as a backup Drive and did not come with backup software. Rather, it was advertised on Seagate's website, in a data sheet, and on the product's box as "instantly" adding storage to the consumer's computer or serving as "add-on storage."[98] Seagate also promoted it as being compatible with the Xbox gaming console.[99] This means that the Expansion Desk, as its name implies, was not meant to be used as a backup device but rather as a second hard drive from which consumers would access files and run programs and games *directly*. Such an application is common because some computers, including most laptops and gaming consoles such as the Xbox, cannot accommodate more than one internal hard drive. Thus, if a consumer wants to expand their storage space, they can either replace their existing

---

[95] FED_SEAG007549.

[96] *Id.* (emphasis added)

[97] *Id.*

[98] *See, e.g.* FED_SEAG0008835, at 8887 (box); Expansion Data Sheet, https://web.archive.org/web/20120416235846/http://www.seagate.com:80/www-content/product-content/expansion-fam/expansion-external/en-us/docs/expansion-external-usb3-datasheet-en-us.pdf; Seagate, *Expansion Desktop*, https://web.archive.org/web/20130612214837/http://www.seagate.com/external-hard-drives/desktop-hard-drives/expansion-hard-drive/ (archived June 12, 2013) (website advertisements).

[99] *See* FED_SEAG0005005 (box stating "Compatible with Xbox One").

internal drive with a larger capacity drive (which can be disruptive) or supplement their existing internal drive with an external one. Given the advertised uses of the Expansion Desk, expecting it to be used for a mere two hours a day is unreasonable.

71. Seagate also sold accessories that could turn any external Drive into a home server and media streaming device, much like the GoFlex Home.[100] All of the external Drives at issue in this case could be used for these purposes because they were compatible with USB 3.0. The term "USB" stands for Universal Serial Bus, and it is the means by which an external hard drive is connected to a computer (i.e. the user plugs the external drive's USB cable into the computer's USB port). This is significant, because USB 3.0 has a raw transfer speed of 625 megabytes per second. The ST3000DM001 has a maximum transfer rate of 210 megabytes per second,[101] which is about one-third of the USB 3.0 peak rate. This means that a consumer using one of Seagate's external Drives with a USB cable would expect to see little difference in performance compared to the same Drive mounted internally in a computer and connected via a SATA interface. As such, I find Adams' assertion that it would be difficult to use the external Drives for anything other than "backup purposes," such as "acting as the primary data store for a computer," to be unsupported. Seagate, at the time, was advertising the external Drives for a variety of operating environments beyond "backup purposes."

72. Adams contends that Seagate requires SBS Drives to meet an MTBF of 100,000 hours, which could "reasonably result in a projected AFR [of] <1% for external, USB products like these" because they were "expected to have fairly low usage."[102] To the extent that Seagate engineers expected the Drives to have a low usage, they clearly were not on the same page as Seagate's marketing department. Moreover, if external Drives like the GoFlex Home and Expansion were used for around 2400 POH a year, which is likely given how they were

---

[100] Seagate, *HD Media Player*, https://web.archive.org/web/20111202061650/http:/www.seagate.com:80/www/en-us/products/home_entertainment/hd-media-player (archived Dec. 2, 2011); Seagate, *File Sharing*, https://web.archive.org/web/20111130142753/http:/www.seagate.com:80/www/en-us/products/network_storage/file-sharing/ (archived Nov. 30, 2011).

[101] FED_SEAG009107.

[102] Adams Decl., at ¶ 56.

advertised, 100,000 hours MTBF would not equate to <1% AFR. Rather, the AFR would be approximately 2.3%.

3. Seagate Documents Indicate That The Internal Drive Kit was an SBS Drive

73. As discussed above and in the Hospodor declaration, Seagate projected a "reduced" AFR of 2.34% for the Grenada Classic SBS and 2.0% for the Grenada BP SBS Drives. Adams argues that these figures are irrelevant because Seagate did not advertise the AFR for SBS drives. However, based upon my review of the documents, it appears that the Internal Retail Kit was indeed an SBS Drive. Although Dewey contends in his declaration that it was not an SBS Drive, his position is contradicted by internal Seagate documents.[103]

74. The Internal Retail Kit was a Drive packaged with cables and other accessories. The retail box that it was sold in stated that it was a "Barracuda" or "Desktop HDD" 3TB Drive. Accordingly, a consumer would reasonably believe that the AFR advertisements for the Barracuda and Desktop HDD applied to it. The below figure is from a standard record that Seagate keeps of warranty returns, and this specific record pertains to an Internal Retail Kit Drive returned by Plaintiff Dortch. It states that the Internal Kit was part of the "Seagate Branded Solutions" (SBS) market segment.

Model www	Capacity	Mkt Seg	Sub Mkt Seg	App Seg	Mkt Name	Internal Name	Design App.
STBD3000100	3000GB	Seagate Branded Solutions	Branded Direct Attached	Branded Direct Attached Storage	DESKTOP HDD INT KIT	3.5 INT RETAIL KIT	PSG

Manufacture		Shipment(2 of 2)		Return	
Serial	Z1F3Q1D2	Ship Date	08-Oct-2013	Return Date	13-Oct-2014
Alt. Serial		Order Category	NB	Issue Date	19-Sep-2014
Customer Serial Number		SPA		Cascaded Return	
Customer Part Number		Protected			
Product	9JB1N4-575	Warranty Status	N	Return Code	WF
Product Substitution		ShipTo Sales Region	NORTH AND SOUTH AMERICA, CANADA	Return Desc.	Warranty Exchange - Field Failure
Source Org	Seagate				

Figure 14: **FED_SEAG0036020, at 36024.**

[103] Dewey Decl., at ¶ 7.

75. Other documents state the same. For example, the below figure contains the relevant columns of a warranty return report generated in April 2016. It shows that the Internal Retail Kit is an SBS Drive.

Return Site Region	Rqstd Market Segment	Rqstd Sub Market Segment Desc	Rqstd Internal Product Name	Rqstd ST Model	Rqstd Product Part Number	*CSO Platform	Rqstd Product Mktg Name	Rqstd Interface
AMER	SBS	Branded Direct Attached	3.5 INT RETAIL KIT	STBD3000100	9JB1N4-576	SBS	DESKTOP HDD INT KIT	SATA
AMER	SBS	Branded Direct Attached	3.5 INT RETAIL KIT	STBD3000100	9JB1N4-576	SBS	DESKTOP HDD INT KIT	SATA
AMER	SBS	Branded Direct Attached	3.5 INT RETAIL KIT	STBD3000100	9JB1N4-576	SBS	DESKTOP HDD INT KIT	SATA
AMER	SBS	Branded Direct Attached	3.5 INT RETAIL KIT	STBD3000100	9JB1N4-576	SBS	DESKTOP HDD INT KIT	SATA
AMER	SBS	Branded Direct Attached	3.5 INT RETAIL KIT	STBD3000100	9JB1N4-576	SBS	DESKTOP HDD INT KIT	SATA
AMER	SBS	Branded Direct Attached	3.5 INT RETAIL KIT	STBD3000100	9JB1N4-576	SBS	DESKTOP HDD INT KIT	SATA
AMER	SBS	Branded Direct Attached	3.5 INT RETAIL KIT	STBD3000100	9JB1N4-576	SBS	DESKTOP HDD INT KIT	SATA
AMER	SBS	Branded Direct Attached	3.5 INT RETAIL KIT	STBD3000100	9JB1N4-576	SBS	DESKTOP HDD INT KIT	SATA
AMER	SBS	Branded Direct Attached	3.5 INT RETAIL KIT	STBD3000100	9JB1N4-576	SBS	DESKTOP HDD INT KIT	SATA
AMER	SBS	Branded Direct Attached	3.5 INT RETAIL KIT	STBD3000100	9JB1N4-576	SBS	DESKTOP HDD INT KIT	SATA
AMER	SBS	Branded Direct Attached	3.5 INT RETAIL KIT	STBD3000100	9JB1N4-576	SBS	DESKTOP HDD INT KIT	SATA

Figure 15: **Warranty Return Report, FED_SEAG0028126**

76. Since the Internal Retail Kit is an SBS Drive, the pre-release AFR that Seagate calculated for the SBS Drives apply to it.[104] The Grenada and Grenada BP SBS Drives were released and sold when the AFR was advertised on the website and April 2011 Product Manual as 0.34% (or “0.34%, <1%”). The AFRs calculated by Seagate – 2.34% and 2.0% – were approximately 688% and 588% greater than the advertised AFR of 0.34%. Even if the AFR was advertised as <1% instead of 0.34%, the aforementioned AFR figures were still significantly higher.

F. Adams Ignores That The ECR Logs and Changed Specifications Demonstrate the Drive was Unstable and Shipped Prematurely

77. The Adams Declaration asserts that the number and pattern of the ECRs cannot be used to determine AFR.[105] No such claim was made in the Hospodor Declaration. Rather, the point that Adams selectively ignores is that an ECR rate of more than one a day is indicative of an unstable, prematurely released product. An ECR is an Engineering **Change** Request. Thus,

[104] I recognize that the internal Seagate document containing the AFR results for Grenada Classic SBS was for the release of the external Drive codenamed “Rockit,” which is the GoFlex. However, the AFR testing itself was on the Grenada (i.e. the ST3000DM001 Drive), not the Rockit as a whole. Moreover, it is my understanding that Seagate has not produced any similar documents for any other Grenada Classic SBS Drives, thus Seagate presumably relied on the AFR contained in the above-mentioned document. In any event, there is no indication that the document containing the results for the Grenada BP SBS Drives was limited to one specific Drive.

[105] Adams Decl. ¶ 88.

although there are some limited exceptions, by definition, an ECR changes the product. If a product is being changed every day, then it is inherently not a stable product.

78. Adams also dismisses as irrelevant the fact that 696 of 732 ECRs for Grenada Classic were designated *by Seagate employees* as "Serious." The employees entering the ECRs had a plethora of choices in making this selection including "minor", "serious", "critical", and "emergency". Adams portrays all the ECRs as being run of the mill, largely insignificant changes, such as qualifying new parts. However, Seagate's own employees, when given the choice closest to Adam's characterization (i.e. minor), instead opted to use "serious." Adams then complains that the Hospodor Declaration does not explain how a serious ECR equates to a problem with the Drives. However, if Seagate's own employees are of the opinion that they need to make 696 "serious" changes to Grenada, then it's self-evident that there were problems with the Drive. Also note that Adams is silent on the 40 *critical* ECRs and the 16 *emergency* ECRs. Adams also opines that the number and pattern of the ECRs is normal.[106] However, Adams offers no evidence to support his contention.

79. Adams next turns to the analysis performed on the ECR data.[107] He criticizes the choice of sorting on some fields rather than others. In particular, Adams dismisses the categorization of Customer Code, Mechanical, and Electrical, despite the fact that it is precisely one of the main categorizations employed by Seagate. Indeed, as part of entering an ECR, Seagate requires the user to make a selection from one of these categories. If it is an irrelevant distinction then Adam's complaint should be with Seagate.

80. Adams claims that the data should have been sorted by ECR reason in an attempt to argue that, since the "Improvement – Quality / Reliability" field purportedly amounted to a mere 3.81% of the issues, the Drive must not have had a material reliability problem. This argument falls flat. In order to make his argument that reliability must not have been an issue,

[106] Adams Decl. ¶ 91. Relatedly, in his report Adams goes to great lengths to argue that "low yield also does not mean the drives were unreliable." *Id.*, at ¶ 85. However, even Seagate's ghostwritten rebuttal to the Backblaze blog posts acknowledges that "Seagate engineers all emphasize how sensitive they are to yield numbers and impact that has on the bottom lines of Seagate and customers alike. 'A high yielding product is typically a highly reliable product' noted one development specialist." FED_SEAG0001029, at 1033.

[107] Adams Decl. ¶ 92.

Adams ignores the number one reason for an ECR, "Improvement – Design Engineering," which, by its very nature, is directly related to reliability. Adams also fails to reference the fifth most common reason, "Correct Error," nor does he mention the sixth most common reason, "Improvement –Manufacturing Process", which means that Seagate is improving the way they make the Drives, which, again, is directly related to reliability. Collectively, the first, fifth, sixth, and tenth reasons in Adams' chart represent 41.26% or 422 of the ECRs.

81. Adams casts aspersions on the source of the data that was used for the analysis. Given that Adams supposedly believes that the data supports his view that the drives were not defective, it's surprising that he would take this position. Regardless, since he raises the question as to where the data came from, I will provide an answer. Although dates are a critical part of any ECR record, the ECR data originally produced by Seagate contained no dates.[108] When asked to remedy this problem, rather than produce the same report with dates, Seagate produced a different report.[109] This report had dates but lacked most of the other information that appeared in the initial production. However, since both reports included the ECR number, it was possible to merge the two data sets. The merged data set can then be analyzed using standard Excel tools which allow selection by various criteria including date ranges.

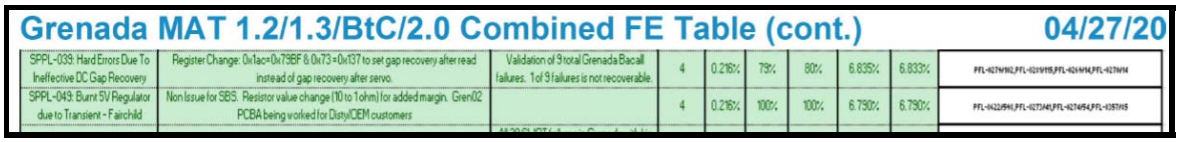
82. After grudgingly accepting that the underlying data are legitimate, Adams dismisses the data as being typical. He is careful to address the timing of the ECRs ("the basic distribution and timing of the ECRs shown do not seem unusual in my experience"), but at no time does he address the number of the ECRs. It is the sheer rate of ECRs that is indicative of a process out of control.

83. As to Adams' criticisms of the ECR examples addressed in the Hospodor Declaration, in nearly each instance, he either misstates my opinion or misses the point entirely. For instance, at Paragraph 95(a) of his declaration, Adams states "there is no indication of a burnt switching regulators in ECR0133245". Adams is correct that the ECR entry makes no

[108] FED_SEAG0027240. Typically, there is a date for when the ECR was raised and at least a date for when it was resolved. There are often other dates such as when the ECR was assigned to an individual to investigate.

[109] FED_SEAG0054825.

such mention of a burnt regulator. However, had Adams reviewed the documents related to this particular ECR, he would have discovered the following entry:


Grenada MAT 1.2/1.3/BtC/2.0 Combined FE Table (cont.) 04/27/20

SPPL-039: Hard Errors Due To Ineffective DC Gap Recovery	Register Change: 0x1ac=0x79BF & 0x73=0x137 to set gap recovery after read instead of gap recovery after servo.	Validation of 9 total Grenada Bacall failures. 1 of 9 failures is not recoverable.	4	0.216%	79%	80%	6.835%	6.833%	
SPPL-049: Burnt 5V Regulator due to Transient - Fairchild	Non Issue for SBS. Resistor value change (10 to 1 ohm) for added margin. Gren02 PCBA being worked for Disty/OEM customers		4	0.216%	100%	100%	6.790%	6.790%	

Figure 16: **FED_SEAG0000065, at 69**

The key language reads:

> SPPL-049: **Burnt 5V Regulator due to transient** – Fairchild. Non issue for SBS. Resistor value change (10 to 1 ohm) for added margin. Gren02 PCBA being reworked for Disty/OEM customers (Emphasis added)

84. Thus, contrary to Adams' assertion, the ECR was indeed related to a burnt switching regulator. He then asserts "that this issue was found and fixed before the Grenada Classic drive was ever released", implying that I was unaware of this. Adams is completely wrong. Below is the relevant excerpt from the Hospodor Declaration:

> Shortly before the Drive was to be put into production, Seagate discovered that it had made a significant design mistake around a switching regulator which could result in the regulator being burnt. Switching regulator circuits are not trivial to design, so a blunder of this magnitude at this stage of development is remarkable.[110]

The point, which Adams completely misses, was that a product that was just about to be put into production contained a major design error that resulted in a component being burnt. Adams does not address this point at all.

85. Adams also comments on ECR0135418, stating that this "this ECR simply allowed use of a second source for the FAN5353 part, and was not a reliability issue nor a design change." Once again, Adams mischaracterizes my opinion and completely ignores the key points. The Hospodor Declaration stated, "It is unclear from the ECR description whether Seagate changed the output voltage (which would be enormously significant) or integrated an

[110] Hospodor Decl., ¶ 138.

alternate part that needed a slight tweak to the resistors."[111] Thus, I recognized the possibility that this ECR was about an alternate part. However, they key points that I made and which Adams ignored were:

> On May 10, 2011, two weeks after the ST3000DM001 was first released to production, ECR0135418 was raised and designated as "**Critical Priority**" and "Improvement- Design Engineering." . . .
>
> Regardless, it is quite remarkable that a change of this type would be made two weeks after the product was released into mass production because such a change is normally processed months before a product is released to manufacturing.[112]

For Adams to characterize a critical priority ECR two weeks after the drive was introduced into production as a routine change defies belief. Finally, Adams claims that this was not a design change. Adams is wrong- changing the values of components, such as resistors, is a design change. In the case of a buck regulator such as the FAN5353, changing the value of the external regulator feedback network (even if the ratio changes the same, such that the nominal output voltage is unchanged) is impactful because it alters the phase margin of the system and hence the stability of the regulator.

86. Adams also addresses on ECR0135418, stating "Dewey confirmed that ECR0135564 was for amount of solder paste applied to the flex circuit where the heads make connect to its preamplifier to improve yield." Adams characterized it as a "minor change and contact failures are easily caught in the factory. It should have no impact on reliability." Once again, Adams avoids the point, which I stated as follows:

> It is critical that the correct amount of solder paste is applied to the printed circuit board, as too much or too little will lead to poor connections. Thus, the correct design and sizing of the solder stencil aperture is a critical step in ensuring a high quality printed circuit board assembly. Again, it is remarkable that within a couple of weeks of the ST3000DM001 being approved for shipment, Seagate needed to change such an important part of the printed circuit board manufacturing process. Problems of this type are normally ironed out as part of a pre-production phase.[113]

---

[111] Hospodor Decl., ¶ 140.

[112] Hospodor Decl., ¶¶ 139-140.

[113] Hospodor Decl., ¶ 142.

Rather than address the underlying problem (that a critical manufacturing step had not been done properly and that production had started), Adams dismisses it as something that is a minor, and that contact failures are easily caught in the factory. I must disagree. Contact failures are **not** easily caught. Rather, contact failures are one of the major sources of intermittent failures. These are precisely the sorts of failures that result in drives being returned to Seagate, only for Seagate to declare them as "NTF."

87. Adams also attempts to address ECR0138496, stating that it simply approved a second source for the head stack assembly ("HSA"). Once again, Adams ignores the significance of the ECR, which was set forth in the Hospodor Declaration as such:

> The HSA is a major component of a HDD, so it was unusual to see a new HSA design being introduced to the Grenada product line only four months into mass production. In fact, the HSA must be a stable to mass produce reliable hard drives.[114]

88. With regarding to the remaining ECRs Adams attempted to provide a rebuttal to, he simply stated he agreed with the Dewey Declaration with very little explanation. These ECRs – ECR0148346, ECR0149074, ECR0149636 and ECR0150131, all relate to a problem with the Drive Separator Plate. Dewey's response is quite remarkable. He starts by stating:

> On May 31, 2012, Seagate issued a ship hold on Grenada Classic drives because of an issue discovered in internal testing: for some disc separator plates (DSPs), one dimension was 5 thousandths of an inch (.005) shorter than they should have been, meaning that there could be contact between another part of the DSP and the disc during a shock event. While DSPs had been in use since 2010, the problem was due to new material and the required tolerances in the new drives. (See Ex. 4 [FED_SEAG0026751], at 26781.) In fact, the problem was rare enough that it only emerged once Seagate began producing larger volumes of drives—the problem didn't surface in smaller productions.

89. Dewey makes many significant admissions:

a. A shock event could result in contact between the DSP and the disk. Dewey ignores the fact that such an incident is catastrophic. Rather, he treats it as something minor.

[114] Hospodor Decl., ¶ 146.

b. The problem allegedly occurred because of new material. The unavoidable conclusion of this statement is that Seagate changed the material specification on a key part without understanding the ramifications of doing so. This is simply careless.

c. The problem also occurred because of tighter tolerances in the new drives. This is a stunning admission, as it confirms that Seagate simply used an existing part in a new drive design without doing the requisite tolerance analysis. This is the epitome of neglect.

d. The problem was "rare enough that it only emerged once Seagate began producing larger volumes of drives." This is perhaps the most interesting admission. The implication is that Seagate's testing procedures were not sensitive enough to detect this problem (which was present from day 1 of the Grenada production). It tacitly acknowledges that Seagate shipped a substantial number of drives with this defect. Furthermore, it indicates that drives suffering from this problem could be labeled as No Trouble Found ("NTF").

90. Dewey then characterizes the string of events that occurred as being perfectly reasonable and ordinary. However, they clearly were not. As I explained in my original declaration:

> On June 25, 2012, ECR 0149074 was raised. This ECR stated:
>
> ECR0148346 [the ECR discussed immediately above] was pushed through as urgent with the understanding that PN 100694007 was only a few days away from being fully qualified. It's been several weeks and the part is still not qualified, thus it is being removed from the BOMs and ECR0148346 is being backed-out![115]

Clearly the source of this ECR (Debra Richardson) was not happy with this state of affairs.

91. In an attempt to argue that the problems with the Drive were temporally limited or otherwise limited only to early iterations, Adams observes that the Hospodor Declaration's ECR analysis was restricted to Grenada Classic.[116] Adams is incorrect. The problems with the Drive continued throughout the class period and across iterations. Below, I present a similar analysis for GrenadaBP which supports my original opinions for Grenada Classic.

92. Seagate produced Engineering Change Request ("ECR") data for the GrenadaBP. The data were produced in two separate spreadsheets. Combining the data from the two

[115] Hospodor Decl., ¶ 151.

[116] Adams Decl. ¶ 90.

spreadsheets, one can log the changes made to the electrical and mechanical components of the Drive, among other things. An example of what the combined data looks like is shown below:

	A	E	G	H	I	J	L	N	O	P	Q	R	S	T
1	Name	Project Name	Modified Cre	Disposition	Priority	Reason	Change Duratic	Description (WbsDescription)						
2	ECR0140566,	SEA GRENADABP CC	10/5/2011	Approved	Serious Priority	Customer Unique Code/Label	Permanent	Create the following Grenada Block Point -999 CCs w/ Luxor+, using all defau						
3	ECR0141714,	SEA GRENADABP CC	11/7/2011	Approved	Serious Priority	Customer Unique Code/Label	Permanent	Create the following new Grenada BP CCs for SSH: 1CM162-999 1CM164-999						
4	ECR0141715,	SEA GRENADABP CC	11/7/2011	Approved	Serious Priority	Customer Unique Code/Label	Permanent	Create the following Grenada BP Depop 2.5TB Native 5Hd CC: 1CH16J-999 Cc						
5	ECR0141716,	SEA GRENADABP CC	11/7/2011	Approved	Serious Priority	Customer Unique Code/Label	Permanent	Create the following WaterFall CC for Grenada BP 500GB: 1CH14C-999 Copy						
6	ECR0142506,	SEA GRENADABP CC	11/21/2011	Approved	Serious Priority	Document update	Permanent	GRENADABP: Revise all CC's as project was not registered prior to being rele						
7	ECR0142658,	SEA GRENADABP CC	12/5/2011	Approved	Serious Priority	Customer Unique Label CC	Permanent	GRENADABP: Create NearLine Lite Engineering Eval -999 Configurations w/ L						
8	ECR0143437,	SEA GRENADABP CC	1/4/2012	Approved	Serious Priority	Customer Unique Label CC	Permanent	Release the following GrenadaBP CTU -900 CCs: 1CH14C-900 500, ST500DM0(						
9	ECR0143445,	SEA GRENADABP CC	1/4/2012	Approved	Serious Priority	Customer Unique Label CC	Permanent	Release the following GrenadaBP CTU -700 CCs for Apple: 1CH162-700 No fir						
10	ECR0143610,	SEA GRENADABP CC	1/9/2012	Approved	Serious Priority	Correct error	Permanent	Correct the following error introduced in ECR0143445,Incorporated,Permane						
11	ECR0143678,	SEA GRENADABP CC	1/11/2012	Approved	Emergency Priority	Unique Test Requirements	Permanent	Correct the user LBA count to 5860533168 (3TB IDEMA LBA) - Revise 1CX166-9						
12	ECR0143945,	SEA GRENADABP CC	1/19/2012	Approved	Serious Priority	Improvement - Design Engine	Permanent	Grenada BP: Removing PCBA foam from 1CH*-999 configs ----------						
13	ECR0144028,	SEA GRENADABP CC	1/24/2012	Approved	Serious Priority	Customer Unique Code/Label	Permanent	GrenadaBP: Create new Grenada BP SBS Tab CCs: Create 1CH162-568 Copy B						
14	ECR0144055,	SEA GRENADABP CC	1/25/2012	Approved	Serious Priority	Customer Unique Code/Label	Permanent	Create the following Grenada BP -300 Disty CCs: 1CH162-300 Copy BOM from						
15	ECR0144066,	SEA GRENADABP CC	1/25/2012	Approved	Serious Priority	Customer Unique Code/Label	Permanent	GRENADABP: Create new NL Lite -900 CTU CC Tabs ----------						

Figure 17: **Combined ECR data**

93. The figure shows some of the key fields including the ECR's disposition, priority, reason for issuance, its duration (permanent / temporary) and its description. Note that I have hidden some fields that are of lesser importance. The following table summarizes the frequency and type of ECRs that were generated.

	Count	Percentage
Total number of ECRs:	725	
ECR's that are minor	3	0.4%
ECR's that are serious	690	95.2%
ECR's that are critical	19	2.6%
ECR's that are emergency	13	1.8%
ECRs that are permanent changes	586	80.8%
ECR's that are CC	369	50.9%
ECR's that are electrical	46	6.3%
ECR's that are mechanical	310	42.8%
ECR's that are approved	697	96.1%
ECR's that are disapproved	28	3.9%
ECR's that are 'None'	0	0.0%
ECR's that are 'investigate'	0	0.0%
CC ECRs after product release	328	88.9%
Electrical ECRs after product release	30	65.2%
Mechanical ECRs after product release	299	96.5%
All ECR's after product release	657	90.6%

Figure 18: **ECR Summary**

94. Below, I list some noteworthy observations from the above chart.

a. 88.9% of ECR's occurred after the Drive was released for mass production.

b. Almost all ECR's were at least "serious."

c. Most ECRs were approved.

d. 80.8% of ECRs were marked as permanent. The remaining 19.2% of the ECRs were called "TEMP DA" or "Temporary Deviation Authorization" by Seagate.

e. Most Customer Code (CC) ECRs occurred after GrenadaBP was approved for production, including 30 electrical ECRs.

f. Two thirds of electrical ECRs occurred *after* GrenadaBP was released to production.

g. Almost all mechanical ECRs occurred *after* GrenadaBP was released to production. This represented 299 changes.

These are significant because mature and stable products tend to have very few changes post-release, and the changes that are made are typically permanent. Thus, a large number of post-release changes is indicative of an unstable product, and a large number of temporary changes is indicative of quick fixes that are made to keep the production line running. For the ST3000DM001, including the Grenada BP, the number of post-release changes were staggering, and a substantial percentage of them were designated as temporary. The following graph shows ECR data plotted by month.

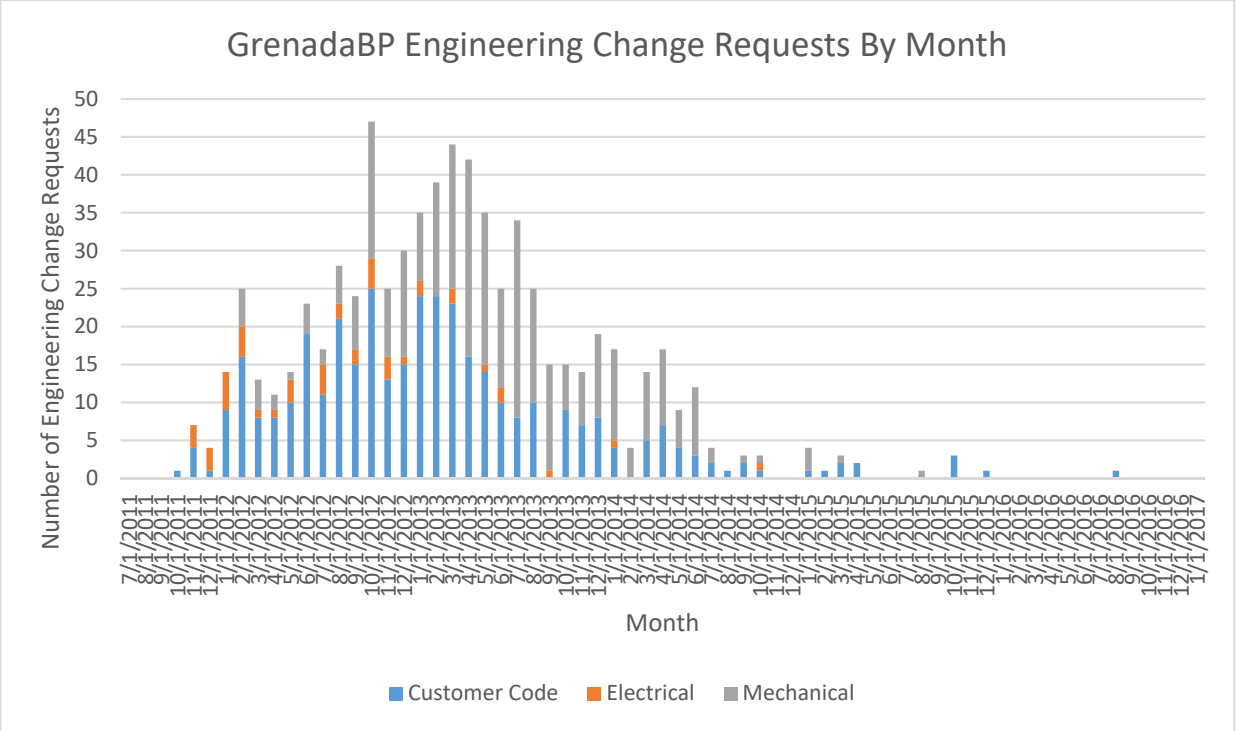


Figure 19: **Grenada BP ECR Chart**

95. The X axis is difficult to read so the graph below expands the first few years ECRs. The yellow highlighting at 4/18/2012 shows approximately when Grenada BP was released into mass production.

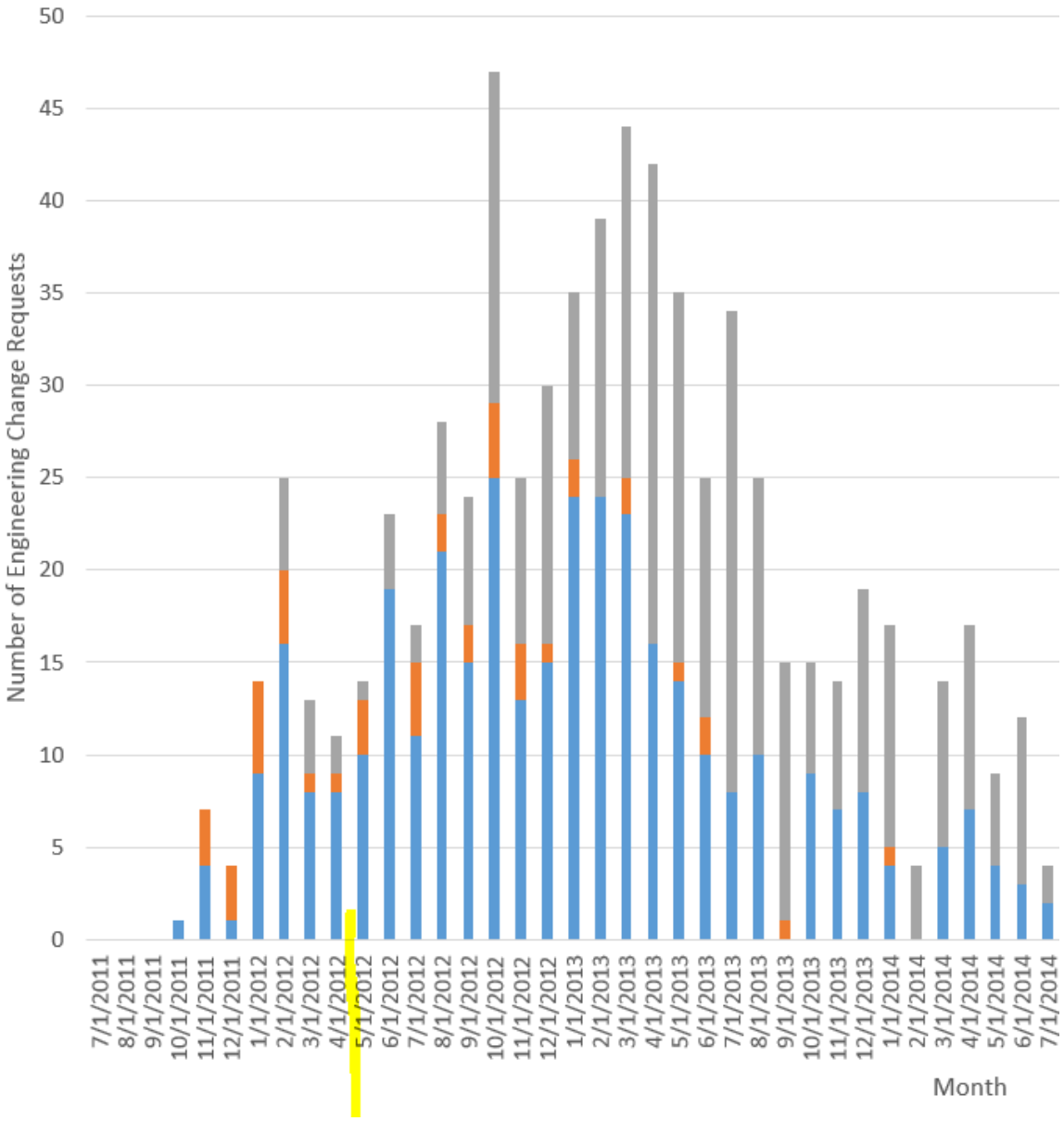


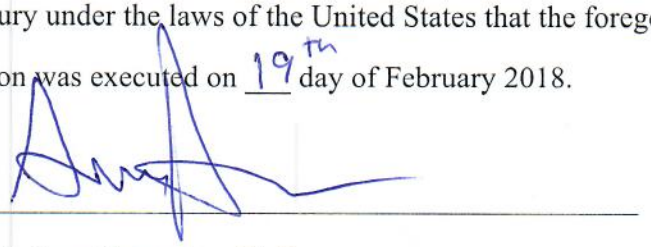
Figure 20: **Grenada BP ECR Chart July 2011 to July 2014**

96. Note that for 8 months the number of ECR was ≥ 30 per month, implying there was at least one change a day. Clearly, Grenada BP was not any more stable than Grenada Classic.

G. Supplementation of Opinions

97. I understand that discovery is continuing and I reserve the right to supplement this declaration or revise my opinion in light of additional information or documents that may be brought to my attention and to offer additional opinions and evidence in reply to any opinions advanced by or on behalf of defendant Seagate.

I declare under penalty of perjury under the laws of the United States that the foregoing is true and correct and that this declaration was executed on 19th day of February 2018.



Andrew Hospodor, Ph.D

APPENDIX 1

MATERIALS RELIED UPON OR CONSIDERED

Pleadings, Discovery Responses, Deposition Transcripts, and Declarations:

Declaration of Donald Adams in Support of Seagate's Opposition to Plaintiffs' Motion for Class Certification.

Declaration of Glen Almgren in Support of Seagate's Opposition to Plaintiffs' Motion for Class Certification.

Declaration of Harrie Netel in Support of Seagate's Opposition to Plaintiffs' Motion for Class Certification.

Declaration of Jeff Fochtman in Support of Seagate's Opposition to Plaintiffs' Motion for Class Certification.

Declaration of Karl Schweiss in Support of Seagate's Opposition to Plaintiffs' Motion for Class Certification.

Declaration of Mary Paneno in Support of Seagate's Opposition to Plaintiffs' Motion for Class Certification.

Declaration of Patrick Dewey in Support of Seagate's Opposition to Plaintiffs' Motion for Class Certification.

In re: Seagate Technology LLC Litigation, Second Consolidated Amended Complaint.

In re: Seagate Technology LLC Litigation, Seagate Technology, LLC's Second Amended Response to Interrogatory Nos. 9 and 10 of Plaintiffs' First Set of Interrogatories.

July 26, 2017 Deposition of Seagate 30(b)(6) Designee Glen Almgren.

September 7, 2017 Deposition of Seagate 30(b)(6) Designee Patrick Dewey.

September 8, 2017 Deposition of Andrei Khurshudov.

October 20, 2017 September 7, 2017 Deposition of Seagate 30(b)(6) Designee Alan Clark.

Websites and Documents Obtained from the Internet:

Seagate, *Barracuda Desktop Hard Drives*, https://web.archive.org/web/20111129033926/http://www.seagate.com:80/www/en-us/products/desktops/barracuda_hard_drives#TabContentSpecifications (click on "Specifications" tab) (archived November 29, 2011).

Seagate, *Barracuda Desktop Hard Drives*, https://web.archive.org/web/20111129033926/http://www.seagate.com:80/www/en-us/products/desktops/barracuda_hard_drives (archived Nov. 29, 2011).

Seagate, *Desktop Hard Drives*, https://web.archive.org/web/20120428124406/http://www.seagate.com:80/internal-hard-drives/desktop-hard-drives/ (archived April 28, 2012).

Seagate, *Barracuda Desktop Hard Drive*, https://web.archive.org/web/20121107201536/http://www.seagate.com/internal-hard-drives/desktop-hard-drives/barracuda/ (archived Nov. 7, 2012) (click on "Specs").

Seagate, *Desktop Hard Drives*, https://web.archive.org/web/20121123050530/http://www.seagate.com/internal-hard-drives/desktop-hard-drives/ (click on "specifications" tab) (archived Nov. 23, 2012)

Seagate, *Barracuda Desktop Hard Drive*, https://web.archive.org/web/20121209052449/http://www.seagate.com/internal-hard-drives/desktop-hard-drives/barracuda/ (archived Dec. 9, 2012) (click on "Specs").

Seagate, *Barracuda Desktop Hard Drive*, https://web.archive.org/web/20130101172949/http://www.seagate.com/internal-hard-drives/desktop-hard-drives/barracuda/ (archived Jan. 1, 2013) (click on "Specs").

Seagate, *Desktop Hard Drives*, https://web.archive.org/web/20130117005718/http://www.seagate.com/internal-hard-drives/desktop-hard-drives/ (archived Jan. 17, 2013).

Seagate, *Desktop Hard Drives*, https://web.archive.org/web/20130911084603/http://www.seagate.com:80/internal-hard-drives/desktop-hard-drives/ (click on "Specifications" tab) (archived September 11, 2013)

Seagate, *Desktop HDD,* *https://web.archive.org/web/20130914024325/http://www.seagate.com:80/internal-hard-drives/desktop-hard-drives/desktop-hdd/* (click on "Specs") (archived Sept. 14, 2013)

Seagate, *Desktop Hard Drives*, https://web.archive.org/web/20140124073650/http://www.seagate.com/internal-hard-drives/desktop-hard-drives/ (archived Jan. 24, 2014).

Seagate, *July 2012 Storage Solutions Guide*, *available at* https://www.seagate.com/files/www-content/product-content/_cross-product/en-us/docs/storage-solutions-guide-sg1351-11-1210us.pdf.

Seagate, *October 2013 Storage Solutions Guide, available at* https://www.seagate.com/files/www-content/product-content/_cross-product/en-us/docs/storage-solution-guide-oct-13-ssg1351-14-1310us.pdf.

Seagate, *September 2016 Storage Solutions Guide, available at* http://www.seagate.com/www-content/product-content/barracuda-fam/desktop-hdd/barracuda-7200-14/en-us/docs/100686584v.pdf.

Seagate, *Expansion Data Sheet*, https://web.archive.org/web/20120416235846/http://www.seagate.com:80/www-

content/product-content/expansion-fam/expansion-external/en-us/docs/expansion-external-usb3-datasheet-en-us.pdf.

Seagate, *Expansion Desktop*, https://web.archive.org/web/20130612214837/http://www.seagate.com/external-hard-drives/desktop-hard-drives/expansion-hard-drive/ (archived June 12, 2013)

Seagate, *HD Media Player*, https://web.archive.org/web/20111202061650/http:/www.seagate.com:80/www/en-us/products/home_entertainment/hd-media-player (archived Dec. 2, 2011).

Seagate, *File Sharing*, https://web.archive.org/web/20111130142753/http:/www.seagate.com:80/www/en-us/products/network_storage/file-sharing/ (archived Nov. 30, 2011).

Seagate, *Firmware Updates for Seagate Products*, http://knowledge.seagate.com/articles/en_US/FAQ/207931en.

Seagate, *Barracuda (1TB/disk platform) Firmware Update*, http://knowledge.seagate.com/articles/en_US/FAQ/223651en.

Seagate, *Hard disk drive reliability and MTBF / AFR* http://knowledge.seagate.com/articles/en_US/FAQ/174791en?language=en_US&key=ka030000000t mWGAAY&kb=n&wwwlocale=en-us (last accessed October 10, 2017).

Western Digital, *How drive reliability is measured and the MTBF of WD drives*, https://support.wdc.com/knowledgebase/answer.aspx?ID=665.

Backblaze, *See What Can 49,056 Hard Drives Tell Us? Hard Drive Reliability Stats for Q3 2015*, (Oct. 14, 2015), https://www.backblaze.com/blog/hard-drive-reliability-q3-2015.

Backblaze, *CSI: Backblaze – Dissecting 3TB Drive Failure* (April 15, 2015), https://www.backblaze.com/blog/3tb-hard-drive-failure.

Backblaze, *How long do disk drives last?* (Nov. 12, 2013), https://www.backblaze.com/blog/how-long-do-disk-drives-last/.

MjM Data Recovery Ltd., Head Stack Assembly, https://www.mjm.co.uk/hard-disk-disassembly/hard-disk-head-stack.html.

Documents produced during discovery (beginning Bates numbers):

See Exhibit A to Appendix 1.

EXHIBIT A TO APPENDIX 1

Begin Bates	End Bates
BB_CTRL0000171	BB_CTRL0000171
BB_CTRL0001322	BB_CTRL0001322
BB_CTRL0001887	BB_CTRL0001887
BB_CTRL0001888	BB_CTRL0001888
BB_CTRL0001894	BB_CTRL0001894
BB_CTRL0002066	BB_CTRL0002066
BB_CTRL0002176	BB_CTRL0002176
BB_CTRL0002185	BB_CTRL0002185
BB_CTRL0003738	BB_CTRL0003738
BB_CTRL0005172	BB_CTRL0005172
BB_CTRL0005181	BB_CTRL0005181
FED_SEAG0000065	FED_SEAG0000089
FED_SEAG0000134	FED_SEAG0000144
FED_SEAG0000145	FED_SEAG0000155
FED_SEAG0000286	FED_SEAG0000296
FED_SEAG0000367	FED_SEAG0000367
FED_SEAG0000476	FED_SEAG000477
FED_SEAG0000496	FED_SEAG0000497
FED_SEAG0001028	FED_SEAG0001028
FED_SEAG0001029	FED_SEAG0001038
FED_SEAG0001039	FED_SEAG0001048
FED_SEAG0001209	FED_SEAG0001215
FED_SEAG0001216	FED_SEAG0001216
FED_SEAG0001217	FED_SEAG0001233
FED_SEAG0001799	FED_SEAG0001799
FED_SEAG0001800	FED_SEAG0001805
FED_SEAG0001808	FED_SEAG0001808
FED_SEAG0001811	FED_SEAG0001811
FED_SEAG0001814	FED_SEAG0001814
FED_SEAG0001817	FED_SEAG0001817
FED_SEAG0001818	FED_SEAG0001848
FED_SEAG0001849	FED_SEAG0001850
FED_SEAG0001851	FED_SEAG0001881
FED_SEAG0001884	FED_SEAG0001884
FED_SEAG0001918	FED_SEAG0001918
FED_SEAG0001919	FED_SEAG0001949
FED_SEAG0001950	FED_SEAG0001950
FED_SEAG0001951	FED_SEAG0001981
FED_SEAG0001984	FED_SEAG0001984
FED_SEAG0001985	FED_SEAG0001985
FED_SEAG0001986	FED_SEAG0002015
FED_SEAG0002016	FED_SEAG0002016
FED_SEAG0002017	FED_SEAG0002047

FED_SEAG0002052	FED_SEAG0002052
FED_SEAG0002109	FED_SEAG0002110
FED_SEAG0002111	FED_SEAG0002112
FED_SEAG0002206	FED_SEAG0002219
FED_SEAG0002273	FED_SEAG0002273
FED_SEAG0002274	FED_SEAG0002275
FED_SEAG0002276	FED_SEAG0002276
FED_SEAG0002280	FED_SEAG0002282
FED_SEAG0002283	FED_SEAG0002287
FED_SEAG0002305	FED_SEAG0002305
FED_SEAG0002306	FED_SEAG0002317
FED_SEAG0002318	FED_SEAG0002319
FED_SEAG0002320	FED_SEAG0002331
FED_SEAG0002332	FED_SEAG0002335
FED_SEAG0002336	FED_SEAG0002336
FED_SEAG0002337	FED_SEAG0002348
FED_SEAG0002349	FED_SEAG0002351
FED_SEAG0002352	FED_SEAG0002355
FED_SEAG0002356	FED_SEAG0002357
FED_SEAG0002358	FED_SEAG0002380
FED_SEAG0002663	FED_SEAG0002664
FED_SEAG0002673	FED_SEAG0002680
FED_SEAG0003622	FED_SEAG0003637
FED_SEAG0003639	FED_SEAG0003676
FED_SEAG0003791	FED_SEAG0003795
FED_SEAG0003813	FED_SEAG0003819
FED_SEAG0003831	FED_SEAG0003832
FED_SEAG0003839	FED_SEAG0003876
FED_SEAG0003912	FED_SEAG0003915
FED_SEAG0004163	FED_SEAG0004200
FED_SEAG0036020	FED_SEAG0036032
FED_SEAG0003916	FED_SEAG0003953
FED_SEAG0004309	FED_SEAG0004347
FED_SEAG0004351	FED_SEAG0004354
FED_SEAG0004355	FED_SEAG0004358
FED_SEAG0004438	FED_SEAG0004475
FED_SEAG0005005	FED_SEAG0005005
FED_SEAG0005007	FED_SEAG0005008
FED_SEAG0005081	FED_SEAG0005100
FED_SEAG0005171	FED_SEAG0005179
FED_SEAG0005335	FED_SEAG0005335
FED_SEAG0005336	FED_SEAG0005362
FED_SEAG0005363	FED_SEAG0005443
FED_SEAG0005949	FED_SEAG0005949
FED_SEAG0005950	FED_SEAG0005971
FED_SEAG0005972	FED_SEAG0005972
FED_SEAG0005973	FED_SEAG0005994

FED_SEAG0006016	FED_SEAG0006018
FED_SEAG0006019	FED_SEAG0006023
FED_SEAG0006027	FED_SEAG0006038
FED_SEAG0006048	FED_SEAG0006049
FED_SEAG0006050	FED_SEAG0006059
FED_SEAG0006060	FED_SEAG0006060
FED_SEAG0006071	FED_SEAG0006074
FED_SEAG0006075	FED_SEAG0006078
FED_SEAG0006082	FED_SEAG0006083
FED_SEAG0006084	FED_SEAG0006087
FED_SEAG0006088	FED_SEAG0006098
FED_SEAG0006099	FED_SEAG0006101
FED_SEAG0006184	FED_SEAG0006193
FED_SEAG0006214	FED_SEAG0006242
FED_SEAG0006271	FED_SEAG0006349
FED_SEAG0006350	FED_SEAG0006350
FED_SEAG0006351	FED_SEAG0006396
FED_SEAG0006420	FED_SEAG0006422
FED_SEAG0006442	FED_SEAG0006445
FED_SEAG0006446	FED_SEAG0006446
FED_SEAG0006447	FED_SEAG0006455
FED_SEAG0006520	FED_SEAG0006520
FED_SEAG0006521	FED_SEAG0006528
FED_SEAG0006529	FED_SEAG0006529
FED_SEAG0006530	FED_SEAG0006531
FED_SEAG0006599	FED_SEAG0006627
FED_SEAG0006755	FED_SEAG0006755
FED_SEAG0007293	FED_SEAG0007305
FED_SEAG0007344	FED_SEAG0007351
FED_SEAG0007549	FED_SEAG0007550
FED_SEAG0007590	FED_SEAG0007599
FED_SEAG0007941	FED_SEAG0007942
FED_SEAG0007943	FED_SEAG0007947
FED_SEAG0007948	FED_SEAG0007948
FED_SEAG0008116	FED_SEAG0008117
FED_SEAG0008438	FED_SEAG0008443
FED_SEAG0008444	FED_SEAG0008454
FED_SEAG0008455	FED_SEAG0008464
FED_SEAG0008465	FED_SEAG0008473
FED_SEAG0008474	FED_SEAG0008477
FED_SEAG0008478	FED_SEAG0008486
FED_SEAG0008487	FED_SEAG0008494
FED_SEAG0008495	FED_SEAG0008501
FED_SEAG0008502	FED_SEAG0008529
FED_SEAG0008805	FED_SEAG0008806
FED_SEAG0008807	FED_SEAG0008807
FED_SEAG0008835	FED_SEAG0008890

FED_SEAG0008911	FED_SEAG0008918
FED_SEAG0008920	FED_SEAG0008925
FED_SEAG0008927	FED_SEAG0008932
FED_SEAG0008933	FED_SEAG0008933
FED_SEAG0008936	FED_SEAG0008941
FED_SEAG0008942	FED_SEAG0008942
FED_SEAG0008943	FED_SEAG0008949
FED_SEAG0008950	FED_SEAG0008950
FED_SEAG0008951	FED_SEAG0008956
FED_SEAG0008957	FED_SEAG0008962
FED_SEAG0008963	FED_SEAG0008969
FED_SEAG0008970	FED_SEAG0008974
FED_SEAG0008975	FED_SEAG0008979
FED_SEAG0008980	FED_SEAG0008980
FED_SEAG0008981	FED_SEAG0008981
FED_SEAG0008982	FED_SEAG0008982
FED_SEAG0008983	FED_SEAG0008987
FED_SEAG0008988	FED_SEAG0008988
FED_SEAG0008989	FED_SEAG0008999
FED_SEAG0009020	FED_SEAG0009022
FED_SEAG0009035	FED_SEAG0009059
FED_SEAG0009061	FED_SEAG0009061
FED_SEAG0009062	FED_SEAG0009084
FED_SEAG0009086	FED_SEAG0009086
FED_SEAG0009091	FED_SEAG0009094
FED_SEAG0009095	FED_SEAG0009104
FED_SEAG0009105	FED_SEAG0009105
FED_SEAG0009107	FED_SEAG0009109
FED_SEAG0009303	FED_SEAG0009304
FED_SEAG0009395	FED_SEAG0009397
FED_SEAG0009398	FED_SEAG0009398
FED_SEAG0009399	FED_SEAG0009399
FED_SEAG0009437	FED_SEAG0009445
FED_SEAG0009470	FED_SEAG0009471
FED_SEAG0009508	FED_SEAG0009513
FED_SEAG0009514	FED_SEAG0009519
FED_SEAG0009520	FED_SEAG0009525
FED_SEAG0009526	FED_SEAG0009538
FED_SEAG0009551	FED_SEAG0009553
FED_SEAG0009554	FED_SEAG0009558
FED_SEAG0009559	FED_SEAG0009569
FED_SEAG0009570	FED_SEAG0009575
FED_SEAG0009576	FED_SEAG0009585
FED_SEAG0009586	FED_SEAG0009590
FED_SEAG0009591	FED_SEAG0009600
FED_SEAG0009601	FED_SEAG0009603
FED_SEAG0009609	FED_SEAG0009609

FED_SEAG0009612	FED_SEAG0009612
FED_SEAG0009624	FED_SEAG0009624
FED_SEAG0009625	FED_SEAG0009631
FED_SEAG0009632	FED_SEAG0009637
FED_SEAG0009638	FED_SEAG0009643
FED_SEAG0009644	FED_SEAG0009650
FED_SEAG0009651	FED_SEAG0009657
FED_SEAG0009658	FED_SEAG0009663
FED_SEAG0009664	FED_SEAG0009669
FED_SEAG0009670	FED_SEAG0009702
FED_SEAG0009703	FED_SEAG0009708
FED_SEAG0009709	FED_SEAG0009737
FED_SEAG0009738	FED_SEAG0009743
FED_SEAG0009744	FED_SEAG0009748
FED_SEAG0009824	FED_SEAG0009836
FED_SEAG0009837	FED_SEAG0009848
FED_SEAG0009849	FED_SEAG0009859
FED_SEAG0009860	FED_SEAG0009870
FED_SEAG0009871	FED_SEAG0009873
FED_SEAG0009874	FED_SEAG0009876
FED_SEAG0009877	FED_SEAG0009878
FED_SEAG0009879	FED_SEAG0009880
FED_SEAG0009883	FED_SEAG0009892
FED_SEAG0009894	FED_SEAG0009896
FED_SEAG0009944	FED_SEAG0009957
FED_SEAG0009959	FED_SEAG0009960
FED_SEAG0010009	FED_SEAG0010054
FED_SEAG0010062	FED_SEAG0010072
FED_SEAG0010073	FED_SEAG0010082
FED_SEAG0010091	FED_SEAG0010091
FED_SEAG0010112	FED_SEAG0010118
FED_SEAG0010126	FED_SEAG0010132
FED_SEAG0010133	FED_SEAG0010174
FED_SEAG0010257	FED_SEAG0010337
FED_SEAG0010338	FED_SEAG0010338
FED_SEAG0010339	FED_SEAG0010420
FED_SEAG0010421	FED_SEAG0010421
FED_SEAG0010422	FED_SEAG0010514
FED_SEAG0010515	FED_SEAG0010515
FED_SEAG0010516	FED_SEAG0010610
FED_SEAG0010611	FED_SEAG0010611
FED_SEAG0010612	FED_SEAG0010700
FED_SEAG0010701	FED_SEAG0010701
FED_SEAG0010702	FED_SEAG0010790
FED_SEAG0010791	FED_SEAG0010791
FED_SEAG0010792	FED_SEAG0010812
FED_SEAG0010813	FED_SEAG0010813

FED_SEAG0010814	FED_SEAG0010865
FED_SEAG0010866	FED_SEAG0010866
FED_SEAG0010867	FED_SEAG0010919
FED_SEAG0010920	FED_SEAG0010920
FED_SEAG0010921	FED_SEAG0010928
FED_SEAG0010929	FED_SEAG0010929
FED_SEAG0010930	FED_SEAG0010936
FED_SEAG0010937	FED_SEAG0010937
FED_SEAG0010938	FED_SEAG0011012
FED_SEAG0011013	FED_SEAG0011013
FED_SEAG0011014	FED_SEAG0011083
FED_SEAG0011084	FED_SEAG0011084
FED_SEAG0011085	FED_SEAG0011151
FED_SEAG0011152	FED_SEAG0011152
FED_SEAG0011153	FED_SEAG0011220
FED_SEAG0011221	FED_SEAG0011221
FED_SEAG0011222	FED_SEAG0011276
FED_SEAG0011277	FED_SEAG0011277
FED_SEAG0011278	FED_SEAG0011341
FED_SEAG0011970	FED_SEAG0011979
FED_SEAG0011980	FED_SEAG0011988
FED_SEAG0011989	FED_SEAG0011989
FED_SEAG0011990	FED_SEAG0011991
FED_SEAG0011992	FED_SEAG0011992
FED_SEAG0011993	FED_SEAG0011993
FED_SEAG0011994	FED_SEAG0011994
FED_SEAG0011995	FED_SEAG0011995
FED_SEAG0011996	FED_SEAG0011998
FED_SEAG0011999	FED_SEAG0012029
FED_SEAG0012031	FED_SEAG0012033
FED_SEAG0012037	FED_SEAG0012037
FED_SEAG0012193	FED_SEAG0012271
FED_SEAG0012274	FED_SEAG0012323
FED_SEAG0012374	FED_SEAG0012378
FED_SEAG0012387	FED_SEAG0012389
FED_SEAG0012443	FED_SEAG0012468
FED_SEAG0012469	FED_SEAG0012472
FED_SEAG0012473	FED_SEAG0012480
FED_SEAG0012481	FED_SEAG0012481
FED_SEAG0012482	FED_SEAG0012484
FED_SEAG0012490	FED_SEAG0012520
FED_SEAG0012522	FED_SEAG0012553
FED_SEAG0012555	FED_SEAG0012582
FED_SEAG0012589	FED_SEAG0012614
FED_SEAG0012621	FED_SEAG0012640
FED_SEAG0012642	FED_SEAG0012661
FED_SEAG0012663	FED_SEAG0012687

FED_SEAG0012701	FED_SEAG0012726
FED_SEAG0012800	FED_SEAG0012826
FED_SEAG0013072	FED_SEAG0013096
FED_SEAG0013098	FED_SEAG0013122
FED_SEAG0013240	FED_SEAG0013258
FED_SEAG0013314	FED_SEAG0013316
FED_SEAG0013317	FED_SEAG0013323
FED_SEAG0013574	FED_SEAG0013608
FED_SEAG0013670	FED_SEAG0013676
FED_SEAG0013687	FED_SEAG0013693
FED_SEAG0013825	FED_SEAG0013892
FED_SEAG0013895	FED_SEAG0013897
FED_SEAG0013898	FED_SEAG0013904
FED_SEAG0013905	FED_SEAG0013912
FED_SEAG0014121	FED_SEAG0014121
FED_SEAG0014164	FED_SEAG0014170
FED_SEAG0014203	FED_SEAG0014206
FED_SEAG0014208	FED_SEAG0014212
FED_SEAG0014355	FED_SEAG0014386
FED_SEAG0014389	FED_SEAG0014409
FED_SEAG0014790	FED_SEAG0014790
FED_SEAG0015033	FED_SEAG0015053
FED_SEAG0015054	FED_SEAG0015078
FED_SEAG0015140	FED_SEAG0015140
FED_SEAG0015399	FED_SEAG0015429
FED_SEAG0015440	FED_SEAG0015451
FED_SEAG0015567	FED_SEAG0015568
FED_SEAG0015659	FED_SEAG0015659
FED_SEAG0015884	FED_SEAG0015884
FED_SEAG0015894	FED_SEAG0015894
FED_SEAG0015898	FED_SEAG0015900
FED_SEAG0015940	FED_SEAG0016021
FED_SEAG0016025	FED_SEAG0016039
FED_SEAG0016040	FED_SEAG0016053
FED_SEAG0016460	FED_SEAG0016460
FED_SEAG0016461	FED_SEAG0016461
FED_SEAG0016565	FED_SEAG0016565
FED_SEAG0016639	FED_SEAG0016639
FED_SEAG0016777	FED_SEAG0016780
FED_SEAG0016781	FED_SEAG0016785
FED_SEAG0016786	FED_SEAG0016803
FED_SEAG0016804	FED_SEAG0016810
FED_SEAG0016811	FED_SEAG0016811
FED_SEAG0016812	FED_SEAG0016817
FED_SEAG0016818	FED_SEAG0016818
FED_SEAG0016819	FED_SEAG0016824
FED_SEAG0016825	FED_SEAG0016825

FED_SEAG0016826	FED_SEAG0016830
FED_SEAG0016831	FED_SEAG0016835
FED_SEAG0016836	FED_SEAG0016838
FED_SEAG0016862	FED_SEAG0016866
FED_SEAG0016867	FED_SEAG0016871
FED_SEAG0016872	FED_SEAG0016874
FED_SEAG0016875	FED_SEAG0016878
FED_SEAG0016879	FED_SEAG0016882
FED_SEAG0016883	FED_SEAG0016886
FED_SEAG0016888	FED_SEAG0016890
FED_SEAG0016893	FED_SEAG0016895
FED_SEAG0016896	FED_SEAG0016898
FED_SEAG0016908	FED_SEAG0016912
FED_SEAG0016913	FED_SEAG0016917
FED_SEAG0016918	FED_SEAG0016922
FED_SEAG0016923	FED_SEAG0016925
FED_SEAG0016926	FED_SEAG0016928
FED_SEAG0016929	FED_SEAG0016931
FED_SEAG0016932	FED_SEAG0016934
FED_SEAG0016935	FED_SEAG0016937
FED_SEAG0016938	FED_SEAG0016941
FED_SEAG0016942	FED_SEAG0016949
FED_SEAG0016950	FED_SEAG0016956
FED_SEAG0016957	FED_SEAG0016962
FED_SEAG0016963	FED_SEAG0016964
FED_SEAG0016965	FED_SEAG0016968
FED_SEAG0016969	FED_SEAG0016984
FED_SEAG0016985	FED_SEAG0016990
FED_SEAG0016991	FED_SEAG0017019
FED_SEAG0017426	FED_SEAG0017438
FED_SEAG0017493	FED_SEAG0017532
FED_SEAG0017785	FED_SEAG0017820
FED_SEAG0017886	FED_SEAG0017896
FED_SEAG0017897	FED_SEAG0017907
FED_SEAG0017913	FED_SEAG0017914
FED_SEAG0017915	FED_SEAG0017919
FED_SEAG0018048	FED_SEAG0018052
FED_SEAG0018053	FED_SEAG0018057
FED_SEAG0018185	FED_SEAG0018188
FED_SEAG0018203	FED_SEAG0018206
FED_SEAG0018735	FED_SEAG0018735
FED_SEAG0018786	FED_SEAG0018787
FED_SEAG0018789	FED_SEAG0018789
FED_SEAG0018791	FED_SEAG0018791
FED_SEAG0018818	FED_SEAG0018819
FED_SEAG0018820	FED_SEAG0018820
FED_SEAG0018822	FED_SEAG0018822

FED_SEAG0018823	FED_SEAG0018827
FED_SEAG0018828	FED_SEAG0018829
FED_SEAG0018931	FED_SEAG0018932
FED_SEAG0018933	FED_SEAG0018933
FED_SEAG0018965	FED_SEAG0018968
FED_SEAG0018992	FED_SEAG0019004
FED_SEAG0019005	FED_SEAG0019005
FED_SEAG0019006	FED_SEAG0019016
FED_SEAG0019017	FED_SEAG0019017
FED_SEAG0019018	FED_SEAG0019029
FED_SEAG0019030	FED_SEAG0019030
FED_SEAG0019041	FED_SEAG0019044
FED_SEAG0019045	FED_SEAG0019094
FED_SEAG0019106	FED_SEAG0019112
FED_SEAG0019113	FED_SEAG0019113
FED_SEAG0019114	FED_SEAG0019114
FED_SEAG0019115	FED_SEAG0019115
FED_SEAG0019116	FED_SEAG0019126
FED_SEAG0019398	FED_SEAG0019436
FED_SEAG0020167	FED_SEAG0020168
FED_SEAG0020169	FED_SEAG0020169
FED_SEAG0020170	FED_SEAG0020170
FED_SEAG0020175	FED_SEAG0020176
FED_SEAG0020172	FED_SEAG0020174
FED_SEAG0020806	FED_SEAG0020857
FED_SEAG0021146	FED_SEAG0021146
FED_SEAG0021194	FED_SEAG0021194
FED_SEAG0021511	FED_SEAG0021568
FED_SEAG0021569	FED_SEAG0021605
FED_SEAG0021613	FED_SEAG0021623
FED_SEAG0021624	FED_SEAG0021634
FED_SEAG0021635	FED_SEAG0021645
FED_SEAG0021665	FED_SEAG0021665
FED_SEAG0021666	FED_SEAG0021685
FED_SEAG0021686	FED_SEAG0021687
FED_SEAG0021688	FED_SEAG0021707
FED_SEAG0021708	FED_SEAG0021708
FED_SEAG0021709	FED_SEAG0021710
FED_SEAG0021717	FED_SEAG0021720
FED_SEAG0021769	FED_SEAG0021782
FED_SEAG0021810	FED_SEAG0021818
FED_SEAG0021819	FED_SEAG0021820
FED_SEAG0021892	FED_SEAG0021893
FED_SEAG0021894	FED_SEAG0021912
FED_SEAG0021913	FED_SEAG0021916
FED_SEAG0021917	FED_SEAG0021937
FED_SEAG0021938	FED_SEAG0021948

FED_SEAG0021949	FED_SEAG0021959
FED_SEAG0021960	FED_SEAG0021976
FED_SEAG0021977	FED_SEAG0021987
FED_SEAG0021998	FED_SEAG0022010
FED_SEAG0022105	FED_SEAG0022109
FED_SEAG0022308	FED_SEAG0022310
FED_SEAG0022700	FED_SEAG0022702
FED_SEAG0022703	FED_SEAG0022703
FED_SEAG0022704	FED_SEAG0022704
FED_SEAG0022705	FED_SEAG0022705
FED_SEAG0022706	FED_SEAG0022706
FED_SEAG0022707	FED_SEAG0022707
FED_SEAG0022708	FED_SEAG0022709
FED_SEAG0022914	FED_SEAG0022920
FED_SEAG0023929	FED_SEAG0023932
FED_SEAG0023938	FED_SEAG0023943
FED_SEAG0024003	FED_SEAG0024008
FED_SEAG0024009	FED_SEAG0024014
FED_SEAG0024052	FED_SEAG0024056
FED_SEAG0024057	FED_SEAG0024059
FED_SEAG0024060	FED_SEAG0024069
FED_SEAG0024080	FED_SEAG0024080
FED_SEAG0024164	FED_SEAG0024266
FED_SEAG0024651	FED_SEAG0024653
FED_SEAG0024654	FED_SEAG0024654
FED_SEAG0024655	FED_SEAG0024657
FED_SEAG0024670	FED_SEAG0024670
FED_SEAG0024671	FED_SEAG0024675
FED_SEAG0024682	FED_SEAG0024683
FED_SEAG0024695	FED_SEAG0024696
FED_SEAG0024743	FED_SEAG0024763
FED_SEAG0024764	FED_SEAG0024764
FED_SEAG0024765	FED_SEAG0024765
FED_SEAG0024766	FED_SEAG0024768
FED_SEAG0025567	FED_SEAG0025572
FED_SEAG0025580	FED_SEAG0025586
FED_SEAG0025587	FED_SEAG0025587
FED_SEAG0025594	FED_SEAG0025596
FED_SEAG0025597	FED_SEAG0025603
FED_SEAG0025618	FED_SEAG0025625
FED_SEAG0025640	FED_SEAG0025641
FED_SEAG0025642	FED_SEAG0025646
FED_SEAG0025907	FED_SEAG0025908
FED_SEAG0025909	FED_SEAG0025911
FED_SEAG0025913	FED_SEAG0025974
FED_SEAG0026113	FED_SEAG0026120
FED_SEAG0026135	FED_SEAG0026185

FED_SEAG0026552	FED_SEAG0026576
FED_SEAG0026577	FED_SEAG0026696
FED_SEAG0026697	FED_SEAG0026750
FED_SEAG0026751	FED_SEAG0026794
FED_SEAG0026795	FED_SEAG0026838
FED_SEAG0026839	FED_SEAG0026866
FED_SEAG0026867	FED_SEAG0026893
FED_SEAG0026894	FED_SEAG0026895
FED_SEAG0026896	FED_SEAG0026898
FED_SEAG0026899	FED_SEAG0026963
FED_SEAG0026964	FED_SEAG0027045
FED_SEAG0027046	FED_SEAG0027174
FED_SEAG0027237	FED_SEAG0027237
FED_SEAG0027238	FED_SEAG0027238
FED_SEAG0027239	FED_SEAG0027239
FED_SEAG0027240	FED_SEAG0027240
FED_SEAG0027241	FED_SEAG0027241
FED_SEAG0027242	FED_SEAG0027242
FED_SEAG0027243	FED_SEAG0027243
FED_SEAG0027285	FED_SEAG0027322
FED_SEAG0027800	FED_SEAG0027802
FED_SEAG0027805	FED_SEAG0027808
FED_SEAG0028126	FED_SEAG0028126
FED_SEAG0027918	FED_SEAG0027930
FED_SEAG0029913	FED_SEAG0029913
FED_SEAG0030293	FED_SEAG0030331
FED_SEAG0030388	FED_SEAG0030390
FED_SEAG0030391	FED_SEAG0030436
FED_SEAG0030777	FED_SEAG0030817
FED_SEAG0030657	FED_SEAG0030700
FED_SEAG0030856	FED_SEAG0030893
FED_SEAG0030932	FED_SEAG0030969
FED_SEAG0031047	FED_SEAG0031090
FED_SEAG0031453	FED_SEAG0031473
FED_SEAG0031474	FED_SEAG0031513
FED_SEAG0031713	FED_SEAG0031732
FED_SEAG0031733	FED_SEAG0031748
FED_SEAG0031749	FED_SEAG0031766
FED_SEAG0031767	FED_SEAG0031788
FED_SEAG0031789	FED_SEAG0031810
FED_SEAG0031811	FED_SEAG0031835
FED_SEAG0031892	FED_SEAG0031923
FED_SEAG0031924	FED_SEAG0031942
FED_SEAG0031943	FED_SEAG0031961
FED_SEAG0031962	FED_SEAG0031980
FED_SEAG0032020	FED_SEAG0032055
FED_SEAG0032239	FED_SEAG0032252

FED_SEAG0032295	FED_SEAG0032331
FED_SEAG0032372	FED_SEAG0032384
FED_SEAG0034829	FED_SEAG0034841
FED_SEAG0034928	FED_SEAG0034928
FED_SEAG0034930	FED_SEAG0034930
FED_SEAG0034931	FED_SEAG0034931
FED_SEAG0034968	FED_SEAG0035006
FED_SEAG0035527	FED_SEAG0035531
FED_SEAG0045752	FED_SEAG0045759
FED_SEAG0053031	FED_SEAG0053031
FED_SEAG0054681	FED_SEAG0054711
FED_SEAG0054712	FED_SEAG0054719
FED_SEAG0054736	FED_SEAG0054736
FED_SEAG0054737	FED_SEAG0054737
FED_SEAG0054745	FED_SEAG0054748
FED_SEAG0054823	FED_SEAG0054823
FED_SEAG0054825	FED_SEAG0054825
FED_SEAG0054826	FED_SEAG0054826
FED_SEAG0054827	FED_SEAG0054827
FED_SEAG0054829	FED_SEAG0054832
FED_SEAG0054833	FED_SEAG0054837
FED_SEAG0054844	FED_SEAG0054853
FED_SEAG0054864	FED_SEAG0054867
FED_SEAG0054893	FED_SEAG0054896
FED_SEAG0054917	FED_SEAG0054921
FED_SEAG0054922	FED_SEAG0054924
FED_SEAG0054925	FED_SEAG0054927
FED_SEAG0054928	FED_SEAG0054929
FED_SEAG0054930	FED_SEAG0054931
FED_SEAG0054932	FED_SEAG0054934
FED_SEAG0054935	FED_SEAG0054937
FED_SEAG0054938	FED_SEAG0054939
FED_SEAG0054950	FED_SEAG0054954
FED_SEAG0054959	FED_SEAG0054962
FED_SEAG0054963	FED_SEAG0054965
FED_SEAG0054966	FED_SEAG0054967
FED_SEAG0054968	FED_SEAG0054969
FED_SEAG0054970	FED_SEAG0054971
FED_SEAG0054972	FED_SEAG0054977
FED_SEAG0054978	FED_SEAG0054982
FED_SEAG0054991	FED_SEAG0054993
FED_SEAG0054994	FED_SEAG0054996
FED_SEAG0054997	FED_SEAG0054999
FED_SEAG0055000	FED_SEAG0055006
FED_SEAG0055020	FED_SEAG0055021
FED_SEAG0055022	FED_SEAG0055025
FED_SEAG0055026	FED_SEAG0055040

FED_SEAG0055041	FED_SEAG0055046
FED_SEAG0055065	FED_SEAG0055067
FED_SEAG0055073	FED_SEAG0055078
FED_SEAG0055084	FED_SEAG0055086
FED_SEAG0055087	FED_SEAG0055093
FED_SEAG0055100	FED_SEAG0055106
FED_SEAG0055127	FED_SEAG0055132
FED_SEAG0055139	FED_SEAG0055143
FED_SEAG0055149	FED_SEAG0055151
FED_SEAG0055152	FED_SEAG0055153
FED_SEAG0055154	FED_SEAG0055156
FED_SEAG0055162	FED_SEAG0055165
FED_SEAG0055166	FED_SEAG0055168
FED_SEAG0055169	FED_SEAG0055170
FED_SEAG0055171	FED_SEAG0055220
FED_SEAG0055247	FED_SEAG0055247
FED_SEAG0055248	FED_SEAG0055248
FED_SEAG0055249	FED_SEAG0055252
FED_SEAG0055253	FED_SEAG0055253
FED_SEAG0055254	FED_SEAG0055261
FED_SEAG0055262	FED_SEAG0055262
FED_SEAG0055263	FED_SEAG0055269
FED_SEAG0055270	FED_SEAG0055271
FED_SEAG0055272	FED_SEAG0055272
FED_SEAG0055273	FED_SEAG0055292
FED_SEAG0055341	FED_SEAG0055359
FED_SEAG0055371	FED_SEAG0055388
FED_SEAG0055389	FED_SEAG0055410
FED_SEAG0055411	FED_SEAG0055431
FED_SEAG0055476	FED_SEAG0055495
FED_SEAG0055589	FED_SEAG0055609
FED_SEAG0055612	FED_SEAG0055632
FED_SEAG0055634	FED_SEAG0055654
FED_SEAG0055656	FED_SEAG0055674
FED_SEAG0055831	FED_SEAG0055849
FED_SEAG0055783	FED_SEAG0055783
FED_SEAG0055784	FED_SEAG0055786
FED_SEAG0055922	FED_SEAG0056034
FED_SEAG0056341	FED_SEAG0056374
FED_SEAG0056259	FED_SEAG0056298
FED_SEAG0056387	FED_SEAG0056398
FED_SEAG0056399	FED_SEAG0056447
FED_SEAG0056540	FED_SEAG0056542
FED_SEAG0056543	FED_SEAG0056543
FED_SEAG0056563	FED_SEAG0056642
FED_SEAG0056914	FED_SEAG0056945
FED_SEAG0056986	FED_SEAG0057050

FED_SEAG0057123	FED_SEAG0057132
FED_SEAG0057214	FED_SEAG0057216
FED_SEAG0057246	FED_SEAG0057259
FED_SEAG0057263	FED_SEAG0057268
FED_SEAG0057269	FED_SEAG0057276
FED_SEAG0057277	FED_SEAG0057403
FED_SEAG0057404	FED_SEAG0057408
FED_SEAG0057409	FED_SEAG0057410
FED_SEAG0057411	FED_SEAG0057423
FED_SEAG0057424	FED_SEAG0057424
FED_SEAG0057425	FED_SEAG0057437
FED_SEAG0057438	FED_SEAG0057438
FED_SEAG0057439	FED_SEAG0057455
FED_SEAG0057456	FED_SEAG0057456
FED_SEAG0057457	FED_SEAG0057470
FED_SEAG0057471	FED_SEAG0057494
FED_SEAG0057495	FED_SEAG0057519
FED_SEAG0057521	FED_SEAG0057537
FED_SEAG0057538	FED_SEAG0057543
FED_SEAG0057544	FED_SEAG0057561
FED_SEAG0057562	FED_SEAG0057562
FED_SEAG0057563	FED_SEAG0057566
FED_SEAG0057567	FED_SEAG0057567
FED_SEAG0057568	FED_SEAG0057571
FED_SEAG0057572	FED_SEAG0057572
FED_SEAG0057573	FED_SEAG0057575
FED_SEAG0057576	FED_SEAG0057576
FED_SEAG0057577	FED_SEAG0057579
FED_SEAG0057580	FED_SEAG0057582
FED_SEAG0057583	FED_SEAG0057601
FED_SEAG0057602	FED_SEAG0057637
FED_SEAG0057638	FED_SEAG0057638
FED_SEAG0057639	FED_SEAG0057648
FED_SEAG0057649	FED_SEAG0057649
FED_SEAG0057650	FED_SEAG0057657
FED_SEAG0057658	FED_SEAG0057659
FED_SEAG0057660	FED_SEAG0057675
FED_SEAG0057676	FED_SEAG0057676
FED_SEAG0057677	FED_SEAG0057684
FED_SEAG0057685	FED_SEAG0057685
FED_SEAG0057686	FED_SEAG0057693
FED_SEAG0057694	FED_SEAG0057694
FED_SEAG0057695	FED_SEAG0057702
FED_SEAG0057703	FED_SEAG0057706
FED_SEAG0057707	FED_SEAG0057714
FED_SEAG0057715	FED_SEAG0057721
FED_SEAG0057722	FED_SEAG0057722

FED_SEAG0057723	FED_SEAG0057730
FED_SEAG0057731	FED_SEAG0057731
FED_SEAG0057732	FED_SEAG0057739
FED_SEAG0057740	FED_SEAG0057740
FED_SEAG0057741	FED_SEAG0057748
FED_SEAG0057749	FED_SEAG0057752
FED_SEAG0057753	FED_SEAG0057753
FED_SEAG0057754	FED_SEAG0057754
FED_SEAG0057755	FED_SEAG0057757
FED_SEAG0057758	FED_SEAG0057758
FED_SEAG0057759	FED_SEAG0057759
FED_SEAG0057760	FED_SEAG0057760
FED_SEAG0057761	FED_SEAG0057770
FED_SEAG0057771	FED_SEAG0057771
FED_SEAG0057772	FED_SEAG0057781
FED_SEAG0057782	FED_SEAG0057783
FED_SEAG0057784	FED_SEAG0057838
FED_SEAG0057839	FED_SEAG0057840
FED_SEAG0057841	FED_SEAG0057896
FED_SEAG0057897	FED_SEAG0057901
FED_SEAG0057902	FED_SEAG0057902
FED_SEAG0057903	FED_SEAG0057904
FED_SEAG0057905	FED_SEAG0057958
FED_SEAG0057959	FED_SEAG0057965
FED_SEAG0057966	FED_SEAG0057966
FED_SEAG0057967	FED_SEAG0057972
FED_SEAG0057973	FED_SEAG0057979
FED_SEAG0057980	FED_SEAG0057981
FED_SEAG0057982	FED_SEAG0058036
FED_SEAG0058037	FED_SEAG0058039
FED_SEAG0058040	FED_SEAG0058088
FED_SEAG0058089	FED_SEAG0058090
FED_SEAG0058091	FED_SEAG0058097
FED_SEAG0058098	FED_SEAG0058109
FED_SEAG0058110	FED_SEAG0058113
FED_SEAG0058114	FED_SEAG0058114
FED_SEAG0058115	FED_SEAG0058116
FED_SEAG0058117	FED_SEAG0058167
FED_SEAG0058168	FED_SEAG0058171
FED_SEAG0058172	FED_SEAG0058173
FED_SEAG0058174	FED_SEAG0058174
FED_SEAG0058175	FED_SEAG0058175
FED_SEAG0058176	FED_SEAG0058183
FED_SEAG0058184	FED_SEAG0058197
FED_SEAG0058198	FED_SEAG0058199
FED_SEAG0058200	FED_SEAG0058233
FED_SEAG0058234	FED_SEAG0058235

FED_SEAG0058236	FED_SEAG0058287
FED_SEAG0058288	FED_SEAG0058288
FED_SEAG0058289	FED_SEAG0058296
FED_SEAG0058297	FED_SEAG0058298
FED_SEAG0058299	FED_SEAG0058304
FED_SEAG0058305	FED_SEAG0058307
FED_SEAG0058308	FED_SEAG0058310
FED_SEAG0058311	FED_SEAG0058313
FED_SEAG0058314	FED_SEAG0058314
FED_SEAG0058315	FED_SEAG0058315
FED_SEAG0058316	FED_SEAG0058319
FED_SEAG0058320	FED_SEAG0058338
FED_SEAG0058339	FED_SEAG0058352
FED_SEAG0058353	FED_SEAG0058369
FED_SEAG0058430	FED_SEAG0058439
FED_SEAG0058456	FED_SEAG0058466
FED_SEAG0058478	FED_SEAG0058491
FED_SEAG0058519	FED_SEAG0058526
FED_SEAG0058527	FED_SEAG0058534
FED_SEAG0058535	FED_SEAG0058541
FED_SEAG0058542	FED_SEAG0058542
FED_SEAG0058543	FED_SEAG0058546
FED_SEAG0058547	FED_SEAG0058551
FED_SEAG0058552	FED_SEAG0058552
FED_SEAG0058553	FED_SEAG0058559
FED_SEAG0058560	FED_SEAG0058560
FED_SEAG0058586	FED_SEAG0058591
FED_SEAG0058592	FED_SEAG0058599
FED_SEAG0058600	FED_SEAG0058608
FED_SEAG0058609	FED_SEAG0058612
FED_SEAG0058613	FED_SEAG0058616
FED_SEAG0058617	FED_SEAG0058630
FED_SEAG0058631	FED_SEAG0058633
FED_SEAG0058634	FED_SEAG0058709
FED_SEAG0058710	FED_SEAG0058711
FED_SEAG0058712	FED_SEAG0058782
FED_SEAG0058783	FED_SEAG0058783
FED_SEAG0058784	FED_SEAG0058809
FED_SEAG0058810	FED_SEAG0058812
FED_SEAG0058813	FED_SEAG0058819
FED_SEAG0058820	FED_SEAG0058846
FED_SEAG0058847	FED_SEAG0058852
FED_SEAG0058853	FED_SEAG0058859
FED_SEAG0058860	FED_SEAG0058866
FED_SEAG0058867	FED_SEAG0058873
FED_SEAG0058874	FED_SEAG0058875
FED_SEAG0058876	FED_SEAG0058880

FED_SEAG0058881	FED_SEAG0058891
FED_SEAG0059618	FED_SEAG0059629
FED_SEAG0060976	FED_SEAG0060982
FED_SEAG0063104	FED_SEAG0063139
FED_SEAG0067917	FED_SEAG0067919
FED_SEAG0068026	FED_SEAG0068059
FED_SEAG0069892	FED_SEAG0069899